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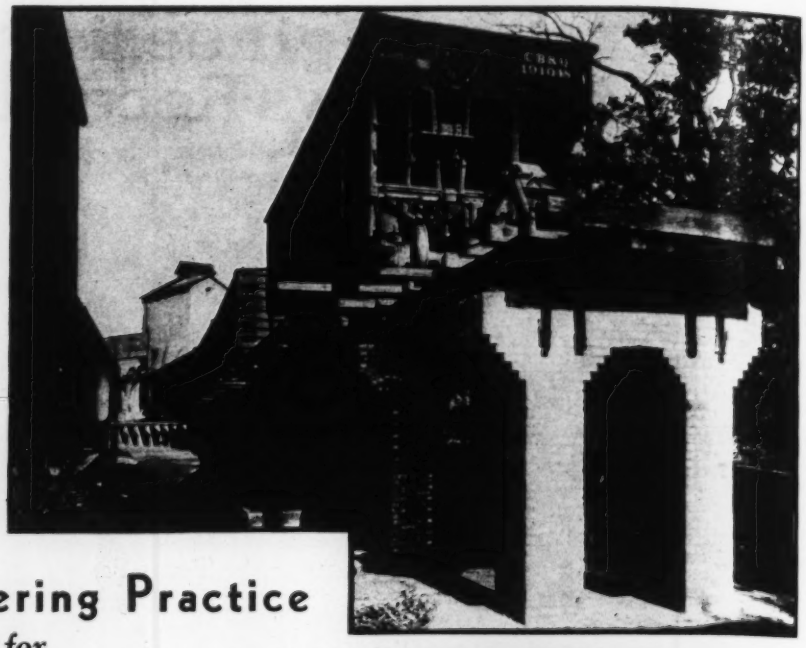

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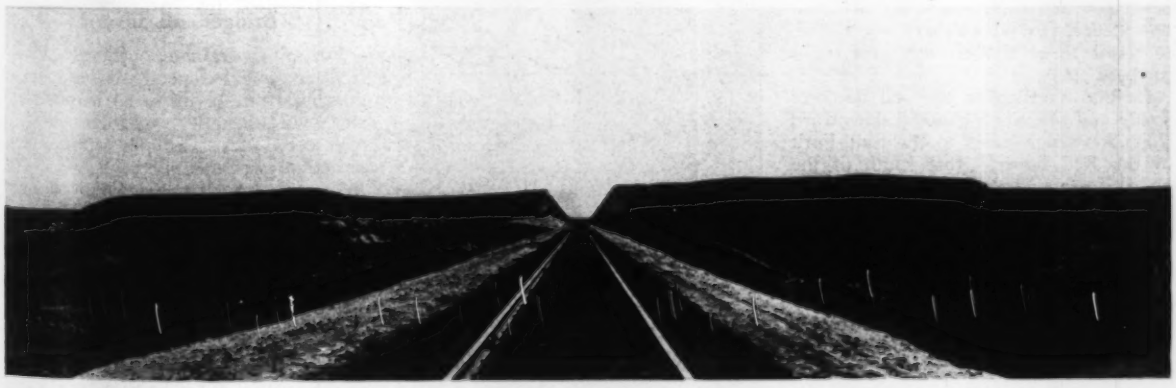
Railway Construction in Texas Panhandle

More than 200 pipe lines crossed by 110-mile railroad in the oil fields between Magic City and Pampa—Grading includes blow sand and gypsum rock—Motorized equipment used largely on construction and tracklaying work

ONE of the largest of recent railway construction projects is the Fort Worth & Denver Northern Railway, extending from Childress, Tex., on the Fort Worth & Denver City Ry., north and northwest to Pampa, Tex., on the Santa Fe Ry. system, a distance of 110 miles, with 20 miles of side tracks and industry lines. This new line, built at a cost of about $4,000,000, is owned by the Fort Worth & Denver City Ry. and the Colorado & Southern Ry., which are parts of the Burlington system.

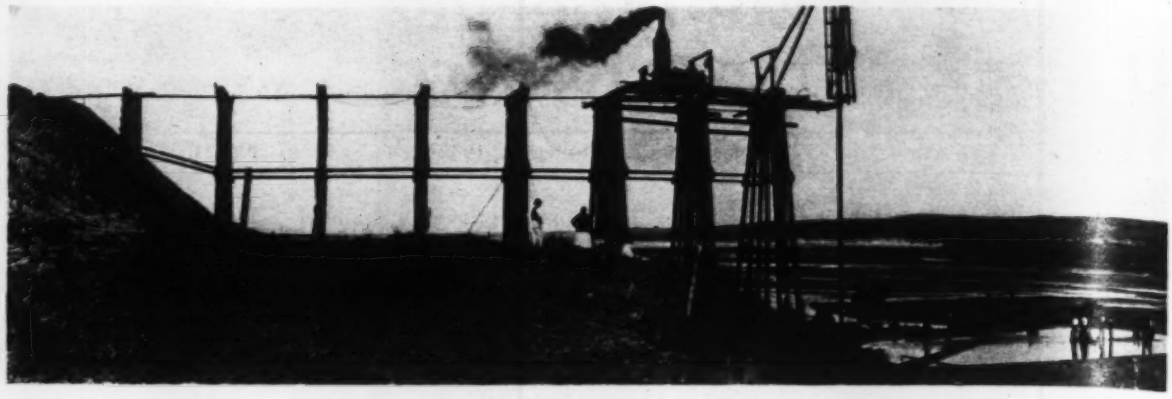
From the map and profile it will be seen that the line connects with the Missouri-Kansas-Texas R.R. at Wellington and crosses the Rock Island Lines at Shamrock; it also crosses three separate forks of the Red River. Between Childress and Shamrock the line traverses a cotton and maize section; between Magic City and Pampa are the Wheeler and Gray oil and gas fields, with their carbon-black and refining industries; at Pampa the line reaches the edge of the Panhandle wheat belt of Texas. From Childress, at El. 1,892, the line rises gradually to El. 2,835 at LeFors, over a rolling plain, with sharp topographical variations due to crossing major drainage channels which run northwest to southeast. Streams have wide beds with low banks; but although these streams drain thousands of square miles, they carry little if any water except at time of heavy rains. From LeFors there is a steady climb of 400 ft. for eight miles to the edge of the Great Staked Plain at Cap Rock, whence it is approximately five miles across a gently sloping plain to Pampa. The line was constructed with a maximum grade of 1 per cent northbound and 0.6 per cent southbound, with a maximum curvature of 4 deg.



Cap Rock cut at the edge of the Great Staked Plain on the Fort Worth & Denver Northern Ry. near Pampa, Tex.

Construction methods

Grading was on a one-way basis and involved approximately 4,000,000 cu.yd. Most of the work was accomplished with the use of power equipment, including 14 gas shovels, one steam shovel, two elevating graders, innumerable trucks, several crawler tractors and dump wagons, tumblebugs and grading machines. However, some teams were used



The Salt Fork of the Red River is crossed by a 46-panel trestle with 20-ft. spans between the pile bents.

where conditions were favorable, and for finishing up the grade work. Gas shovels ranged from 1-yd. to 1½-yd. capacity, while the steam shovel had a 2-yd. dipper. Trucks were from 2- to 5-cu.yd. capacity, with the latter predominating.

From Childress to the Prairie Dog Town Fork of Red River, 11 miles, across a rolling farm country, a practically steady southbound grade of 0.6 per cent was used to secure proper height for crossing the river at El. 1,658. Here excavation was almost entirely earth, and grading was done principally by two gas shovels and an elevating grader, with 2½-yd. dump trucks hauling into embankment. For two miles south of the river the soil is blow sand, and it was necessary to top the fills with clay to prevent erosion from high winds. A 96-panel creosoted-pile trestle was constructed over the river.

From the river the line cuts through a rock bluff and proceeds across rolling and somewhat broken pasture land for about seven miles, and thence on a 12½-mile tangent, across Buck Creek with a 61-panel bridge at El. 1,792, and over rolling farm lands into Wellington. Three distinct forms of gypsum rock were encountered in the series of cuts extending for seven miles north of Prairie Dog Town Fork. Great difficulty was experienced in blasting, due to mud seams in the rock dissipating the force of explosions, causing it to break into boulders which were too large to handle, and which consequently had to be drilled and shot. In order to finish on schedule it was necessary, for a time, to work three shovels day and night in these cuts.

Beyond Wellington the soil becomes sandy and there is a gradual downward slope for seven miles to the Salt Fork of the Red River. Just south of the river it was necessary to top out the embankment with better material on account of the sandy character of the soil. A grade of 0.6 per cent was used to reach the river and cross it at El. 2,040. Several lines were run to secure a lower crossing of this stream, but topographic conditions made it impracticable to cross at a lower elevation.

A 46-panel pile trestle of special design was used for this crossing. It is the highest bridge on the project, being at one point 57 ft. above the river bed.

Beyond the bridge a sharp climb for one mile and a steady upward incline for eight miles are followed by a declining grade for two miles to Elm Creek, which is bridged with a 26-panel pile trestle. Location of this crossing without excessive fill presented considerable difficulty, due to the depth and width of the ravine section. A solid deposit of almost pure gypsum, peculiarly laminated and having the transparency and general appearance of mica, was uncovered north of the Salt Fork.

From Elm Creek to Shamrock, seven miles, is rolling farm country. Shamrock is on a ridge running east and west and occupied by the Rock Island Lines, which, together with improvements in the city, complicated location and necessitated some very heavy construction and the establishing of a 1 per cent grade northbound and 0.6 per cent southbound into the town. The line then passes northwesterly through a cross-drainage country for approximately three miles to a point near the North Fork of Red River. Here the heaviest grading was encountered, with deep cuts of solid rock and high fills, one cut being 2,700 ft. long and another 45 ft. deep. Cuts were opened up by tumblebug and crawler tractor, and excavated by a 2-yd. steam shovel served by 5-yd. trucks.

Fort Worth & Denver Northern Ry. opens up new country in Texas.

The line skirts the North Fork, at a distance never greater than two miles, for approximately 20 miles, over a rolling irregular plain, distinguished principally by the very sandy character of the soil. For seven miles south of McClellan Creek, blow sand drifted so badly that the contractor found it necessary to lay woven-wire mesh over roads to enable the trucks to secure sufficient traction to load and haul into embankment. Progress was consequently slow. Clay was hauled from as far as two miles to top out the fills. From McClellan Creek the line continues to follow the North Fork for ten miles, then crossing it with a 45-panel pile trestle and continuing along the north side of the stream for five miles into LeFors.

There is a steady climb with a compensated 1 per cent grade from LeFors to the Cap Rock. Five miles of this distance is through heavy cuts of solid rock. Two gas shovels, with crawler wagons dumping from either side or end and drawn by tractors, working double shifts, did the grading from the North Fork to the top of the Cap Rock, while teams with grading machine and trucks worked into Pampa.

Bridges and culverts

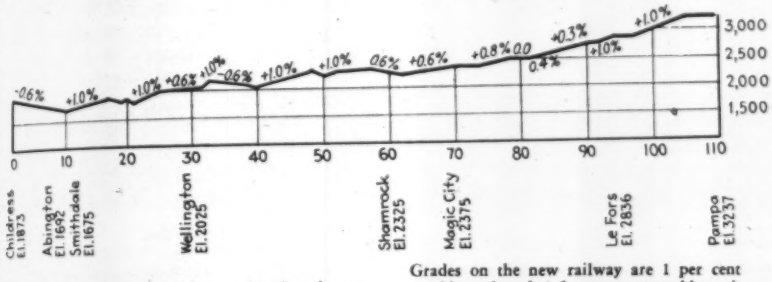
For minor drainage openings, galvanized corrugated-metal culvert pipe, ranging from 12 in. to 84 in. in diameter, was installed. Bridges are of open-deck creosoted pile trestle construction, with five-pile bents and 13½-ft. spans, except that long high bridges have six-pile bents, and the Salt Fork bridge, above, has seven-pile bents. On the Prairie Dog Town Fork bridge and the Salt Fork bridge the spans are 20 ft. Both drop and steam hammers were used for piledriving. At the Prairie Dog Town Fork crossing there was unusual variation in penetration secured, in some cases the dif-

ference in adjoining piles amounting to as much as 10 ft., indicating fissures of considerable breadth and depth in the rock.

Nine grade-seperation structures were constructed. Second-hand turntable girders were utilized at two highway underpass locations by cutting them to 50-ft. length and placing them on pile piers with standard open-deck trestle approaches.

Pipe lines cause trouble

The grade intersects more than 200 pipe lines, most of them being oil, gas and gasoline lines, ranging from 2 to 20 in. in diameter, and located between Magic City and Pampa. All lines crossing at fills were cased, while those crossing at cuts were lowered and cased.



Grades on the new railway are 1 per cent northbound and 0.6 per cent southbound. The line rises 943 ft. in 110 miles.

In some instances, where depth of cut would necessitate excessive excavation for lowering, or where the angle of crossing was very acute, the lines were relocated, with the consent of the owners, for a more favorable and less expensive crossing. From the time the locating party left Shamrock until within two miles of Pampa, on the Cap Rock (approximately 46 miles), it was constantly troubled with oil wells, storage tanks, boilers and other similar equipment which had to be avoided without introducing additional curvature and excessive grading into the line.

Track construction

Track is laid with 90-lb. rail for the first 20 miles and then 85-lb. rails. It was ballasted with gravel to the Prairie Dog Town Fork, while volcanic ash from northeastern New Mexico was used thence to Pampa.

Track was laid by company forces, with some departure from the usual methods. Ties and fastenings were distributed by truck just far enough in advance of the pioneer car to keep hauling distance to a minimum and still furnish sufficient ties to avoid delay to the train. Rails were handled by two cranes, one on the pioneer car transferring them from this car to the track, and the other, two cars back, transferring rails to the pioneer car. With this method it was possible to lay two miles of completed track per day. Ballast was spread on the first lift as close behind tracklaying as possible, to facilitate movement of heavy material tracks to the front.

Stations and sidings

Brick veneer stations were constructed at Wellington, Shamrock and Pampa, and temporary rebuilt box-car stations at five points on the line. There are six sidings in addition to those at the eight stations. Interchange facilities were provided for connection with the Missouri-Kansas-Texas at Wellington, the Rock Island at Shamrock, and the Santa Fe at Pampa. A 3½-mile spur was constructed to the Texas Elf Carbon plant near Pampa.

Many deep cuts were required as much of the line crossed the line of natural drainage.

Engineers and contractors

All survey and construction was under the direction of R. C. Gowdy, chief engineer of the Colorado & Southern Ry. and the Fort Worth & Denver City Ry. The work was in direct charge of A. P. Briggs, construction engineer, having headquarters at Childress, with J. F. McDowell as office engineer. There were eleven resident engineers, each residency covering approximately ten miles. A preliminary survey, under the direction of Mr. Briggs, was begun in June, 1929.

Construction was commenced in December, 1930, but only a few thousand yards of earth was moved prior to letting the general contract for grading and bridging to the Hamilton & Gleason Co., of Denver, and Roberts Bros., of Chicago, on a joint bid. Their forces began moving onto the work on Aug. 26, 1931. For the general contractors, the work was under the direction of C. H. Berry and G. W. Roberts. Subcontracts for general work were let to the following: Barker Bros., Denver, Colo.; Green & Brown, Rogers, Ark.; Roy Skousen, San Bernardino, Calif.; Hamilton & Gleason, Denver, Colo.; Kadane Construction Co., Frederick, Okla.; Oran Speer, Alvord, Tex.; Roberts Bros., Chicago, Ill.; and J. S. McKnight, Amarillo, Tex. A subcontract for all bridging was let to the Peppard & Fulton Co., Minneapolis, Minn.

Power to Be Developed at Aswan Dam

A hydro-electric power plant is to be built at the Aswan Dam in Egypt in connection with the work of raising the crest of the dam, according to *The Engineer*, London. Raising the dam is under way and will provide increased head and an increased storage capacity, making the development of hydro-electric power more attractive than in the past. The proposed generating station will have four turbine-driven generators of 40,000-kw. capacity each. The work is to be financed by the Egyptian government out of revenue and will be one of the most important public-utility operations undertaken in Egypt in recent years. It is proposed to use the power for the manufacture of nitro-chalk and other artificial fertilizers, the surplus power being available for pumping and irrigation schemes in the Aswan and other provinces that now require more expensive oil fuel and coal. The power plant erection is expected to require four years, and as the fertilizer plant will only require two years for its construction it will not be started until a later date. Sir Murdock Macdonald & Partners, Westminster, England, are engineers for the Egyptian government.

Intensive Street-Traffic Studies in Chicago

Metropolitan area contains many bottlenecks on routes to central business district, indicating need of express highways—Commercial traffic requires special consideration—Regional attack on problem necessary

FOR SEVERAL MONTHS a state commission in Illinois has been collecting information and holding hearings throughout the state looking toward the formulation of a future road-building program that is based on fundamental factors representing traffic needs. In the Greater Chicago area cooperative surveys and studies have been carried out on a comprehensive basis, with Illinois and Indiana state, county and municipal organizations taking part. A report on basic traffic facts has recently been issued by the committee on traffic and public safety of the Chicago city council and transmitted to the state commission as its contribution toward the solution of the problem. Next year the 10,000-mile $400,000,000 state highway system will be completed, but there yet remains the necessity for more secondary roads and improvement of routes in urban areas where congestion limits the efficiency of the entire highway system. It is the second state highway problem in the Chicago area that is dealt with in this report.

The Chicago traffic problem with its many ramifications is far broader than the jurisdiction of any local government. It is an integral part of the state highway problem, and divided authority cannot deal effectively with its larger aspects. The essence of the problem lies in the segregation of through traffic from local traffic; the bypass problem of the state highway in relation to the small city becomes the overpass or underpass problem in the metropolis. John A. Massen, chairman of the city committee that prepared the report, states that there is a real possibility that superhighways with separated grades would pay for themselves. Thousands in Chicago do not own cars because congestion precludes their use. One in four outside the city has a car, while only one in six city residents is a car owner. If the major trunk routes in the Greater Chicago traffic area, says Mr. Massen, can be given a fraction of the efficiency now possessed by the typical rural highway, a tremendous increase in user revenue will be inevitable.

With a view toward rendering factual assistance in solving the problems, a searching inquiry was made as to the value of past accomplishments and for the purpose of obtaining a clearer view of future needs. The study was committed to no type of major traffic improvement, though preliminary investigations led to the conclusion that the orthodox type of street construction was inadequate to satisfy either present or future needs and that superhighways held such theoretical and potential advantages as to warrant serious consideration. Three fundamental questions were set up: What is the volume of the traffic demand? Where does traffic originate and go to? And what type of service is rendered by existing and proposed construction?

For the volume and movement problems, counting stations were located throughout the city from the center outward upon all important traffic streets. Responsibility was divided at city limits between city and states. For facility of movement ten runs were made over selected routes. Some measure of the magnitude and complexity of the problem is to be noted from the facts that Chicago has 4,098 miles of paved streets and alleys, and that traffic has increased 90 per cent on the average in 50 counting stations in the seven-year period ending in 1931. At four stations the increase ranged from 500 to 2,200 per cent. Only seven stations showed declines. Cordon counts of automobiles entering the central business district increased from 92,425 per day in 1926 to 119,951 in 1931. Car registration

Vehicular traffic flow in the Greater Chicago traffic area, measured in terms of vehicles per foot of net pavement width on a typical 24-hour week day in August, 1931.

increased from 289,948 in 1925 to 417,925 in 1931. Likewise the trucks increased from 48,262 to 55,923.

Comparisons were made between rural and urban traffic flow, and one of the charts showing traffic pressure—i.e., vehicle movement per foot of net pavement width—is reproduced here. The resulting pattern differs greatly from a volume map, as it shows clearly the bottlenecks. Flow in excess of 600 vehicles per 24 hours is shown in black. This "pressure" per foot is considered the point above which relief is badly needed.

A facility-of-movement chart indicates that speeds are slowed up progressively by congestion as the central business district is approached. Indicative of possibilities is Ericson Drive, a superhighway to the south along the shore line. It shows an average speed of 25 to 30 miles per hour leaving the central district, which speed is stepped up another 10 miles per hour in a distance of 1½ miles.

Conclusions reached are as follows: Urban areas show relatively great traffic activity because of their comparatively high population density and because, in final analysis, it is people who make traffic. While traffic is widespread and intense throughout the Greater Chicago traffic area, a detailed analysis of volume reveals certain routes that are dominant in the pattern because of their location and connections, and especially because of a superior type of improvement that has rendered them great generators of traffic activity.

The major street and highway system of the Greater Chicago traffic area shows a very serious lack of continuity because local improvement law does not encourage the development of projects of region-wide importance and because the size of the problem and physical difficulties involved have made it impossible for the city to keep pace with the rapidly growing needs.

The nature of the traffic demands and their distribution throughout the area make it necessary to determine in the near future whether continuity of flow and unity for the entire system is to be obtained through the extension and improvement of scores of grade routes, or through the development of a relatively few routes of superhighway type.

Commercial traffic, because of its importance as the principal mover of commodities, deserves much more consideration in the future, for it has been excluded from many of the best routes that have been developed for the exclusive use of passenger vehicles.

A translation of traffic flow into terms of movement per foot of pavement width shows heavy and widely fluctuating loadings throughout the area and supports the conclusion that there is need for much more adequate, uniform and continuous route development.

A very substantial percentage of highway traffic entering the city is destined to traverse a relatively small area commonly known as the central business district. This confirms the belief that provision should be made for uniform and adequate routes directly to the heart of the community and that major flows of traffic can be accommodated by relatively few such routes.

City routes that carry so large a proportion of the total traffic of the state are found to afford very inferior accommodations so far as facility of movement is concerned. Facility varies widely, which indicates a failure to adjust the character of the development to the nature of the demand. Furthermore, those portions of routes with a superhighway type of construction show an efficiency that is far superior to that afforded by normal grade routes.

Miller McClintock, director, the Albert Russell Erskine Bureau, Harvard University, acted as consultant to Mr. Massen's committee.

Sealing Cracked Asphalt for Resurfacing

Asphalt emulsion blotted with fine slag seals cracked sheet asphalt and furnishes binder course for cold mix resurfacing

By B. P. MacWhorter
State Highway Engineer of Georgia, Atlanta, Ga.

A CONSIDERABLE mileage of bituminous base with sheet asphalt top has been constructed on roads in the southeastern coastal section of the state of Georgia. This pavement has been subjected to severe tests from floods and capillary water from a high water table, which have resulted in very serious cracking. The cracks are from ½ in. down to hair cracks, the result resembling the check cracking in concrete.

The problem of resurfacing these roads presents the difficulties of sealing the cracks effectively and of bringing the surface to a smooth grade. It was successfully solved by the Wm. P. MacDonald Construction Company, for about 15 miles of resurfacing in Bryan County. The plans called for a ¾-in. resurfacing. This was sufficient for trueing up the surface but cared for sealing the cracks only from the top.

The problem was to devise a treatment of the old surface which would definitely seal the old cracks and provide a layer of material to care for new ones without providing a plane of slippage. After numerous tests and on the recommendation of all the engineers concerned, an asphalt emulsion of the quick-break type was selected. It is characteristic of this emulsion that it is applied cold, and this insured that the asphalt would be deposited from the bottom of the crack up. Its ability to coat the stone uniformly and retain at once all the aggregate which was needed as cover material insured that there would be no bleeding to soften the cold-mix top.

The work progressed rapidly in spite of the fact that traffic could not be detoured. This made it necessary to spray half of the 18-ft. pavement at a time. A distributor load covered about 1,800 ft. 9 ft. wide at the rate of ⅓ gal. per square yard. This was covered immediately with 28 lb. of No. 6 slag graded from ½ in. to 10-mesh. The covering was done from piles beside the pavement in order to use as much labor as possible and while the distributor was loading. As soon as another load arrived it was sprayed on the opposite side of the road, on the next 1,800-ft. section, skipping 1,800 ft. This allowed the preceding section to be rolled without interference from traffic, and kept traffic detouring on only 1,800 ft. at a time. As soon as rolling was completed traffic was allowed on the surface treatment. This was usually after about one hour, although on several rainy days when the pavement and slag were damp this period was lengthened in order to allow the emulsion to set more perfectly.

The surface treatment was left under traffic for a minimum of one week before covering it. During this time the small amount of drift which collected on the edges was salvaged and used on the work ahead. This gave a close check on the amount of material used, and it developed that ⅓ gal. of asphalt emulsion retained 26 lb. of slag per square yard.

Traffic on this road, which is U. S. Route No. 17 from Savannah to Jacksonville, is very heavy and fast, making it extremely difficult to construct a surface treatment on the comparatively smooth and unyielding sheet asphalt surface. Under such conditions a great deal of the cover material is knocked off before it is set, leaving too large a proportion of asphalt to the stone,which results in bleeding. In this case, skillful handling and the ability of the emulsion to grip the stone quickly gave an exceptionally good mat and a surprisingly small proportion of loss.

Surfacing progressed rapidly after all of the treatment was completed, and the cold-mix top bonded perfectly.

Erecting Roof Trusses in Rockefeller Center

Erection plant in International Music Hall comprised six guy derricks supplemented by a falsework tower consisting of a bay of steel six stories tall destined for use in an adjacent skyscraper—Four 65-ton trusses in Sound Theater lifted into place complete

ERECTION of the roof trusses in the Sound Theater and the International Music Hall, the two theaters of Rockefeller Center in New York City, occasioned the development of some interesting procedure. In the Sound Theater the need for falsework was eliminated by assembling 65-ton trusses of 120- and 128-ft. span on the floor of the auditorium and raising them into place complete. In the International Music Hall the weight of the trusses and their long spans precluded similar procedure, and the members were assembled on falsework. For the trusses that run lengthwise of this theater the falsework was made up of about 350 tons of columns and girders, destined for use in the 69-story RCA Building, which was in course of erection on the adjacent block. Briefly, all steel for one bay of the near-by RCA Building, between the 56th and 61st floors inclusive, was used for this falsework, which was erected as a tower bent along the transverse center line of the auditorium. A timber tower bent was used under the proscenium truss.

International Music Hall

The truss layout in the International Music Hall is shown on the plan and elevation of Fig. 2 and was described fully in a preceding article in *Engineering News-Record*, Nov. 17, 1932, p. 583. The auditorium floor, over which six trusses span longitudinally and one (the proscenium truss) spans transversely, is surrounded by tier framework on three sides. On the fourth side, to the west, is the 31-story R.K.O. office building, the steel for which was erected before superstructure work on the theater was begun.

The basic erection plan involved, first, the erection of the columns and beams supporting the orchestra floor and then the assembly of four 30-ton, 75-ft. boom guy derricks at the approximate elevation of the bottom chords of the trusses. Two of these derricks were placed on a setback of the office building at the west end of the theater, and two were placed on the tier framework at the east end, on either side of the stage, the framework being built up to the required elevation in the usual manner. These two derricks then erected the back-wall columns of the stage and some of the tier framework along either side of the theater. At the same time the derricks on the building setback erected the cantilever balcony framing at the rear of the theater. The cantilever girders, the largest of which weighed 25 tons, had to be carefully posted 1 in. high at each end to allow for dead-load deflection.

All four derricks were then turned to the principal job, which was truss erection. While most of the truss steel could be placed by these derricks, they could not reach the steel in trusses T3 and T4 or some of the center members in the other longitudinal trusses. Accordingly, two additional derricks, each of 20-ton capacity, were placed on the falsework staging between trusses T4 and T5 and T2 and T3, respectively. These six derricks, having a combined

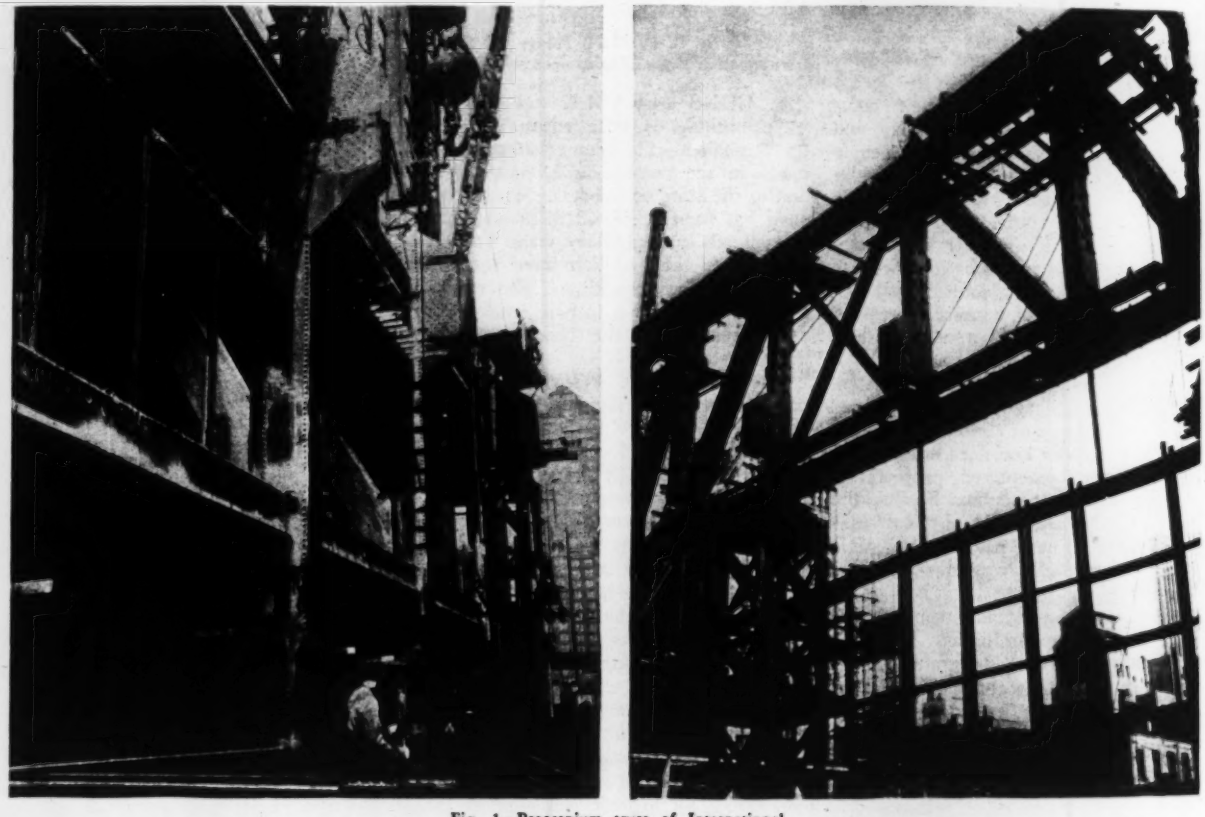


Fig. 1—Proscenium truss of International Music Hall (right), weighing 300 tons, is believed to be heaviest steel building truss ever built. The bottom chord, weighing 60 tons, represented the heaviest single pick. Gussets on truss and on building columns in left view form connections for longitudinal trusses over auditorium.

capacity of 160 tons, constituted the erection plant for the trusses. The location of the derricks at the ends of the theater was such that steel could be picked directly from unloading trucks in the streets, along either side of the theater.

Proscenium Truss—The proscenium truss is believed to be the heaviest steel truss ever used in a building. It weighs 300 tons, has a span of 110 ft. and is 36 ft. deep. Falsework under one panel point was adjudged to be sufficient to support this truss during erection. This falsework, shown in Fig. 1, was a timber tower 9 ft. square, 112 ft. high and founded on a grillage of 12x12-in. timbers at sub-basement level and braced by a system of steel beams inserted at stage-floor level. The posts were also 12x12 in., while struts and diagonals consisted of 3x12-in. plank. The tower was built and assembled elsewhere and then knocked down for shipment to the job. All framing joints and splices were bolted and reinforced with steel plates. On top of the falsework the truss was carried on two 100-ton hydraulic jacks supported by an I-beam grillage.

The bottom chord of the proscenium truss weighed 60 tons and came to the job in three sections which were assembled into a single piece on the auditorium floor, using 50 per cent pins and 50 per cent bolts. It was then lifted into place on the timber falsework tower and the supporting columns by means of the two 30-ton derricks standing at either side of the stage. For placing the center web and top-chord members it was necessary to lengthen the 75-ft. booms of these derricks to 90 ft.

Because the proscenium truss contained an odd number of panels, the falsework tower had to be placed one-half panel, or about 14 ft., off the center line. With the tower in this location it was not possible for the jacks on the falsework to provide all the camber necessary in the opposite end of the truss. Accordingly, 1⅛-in. steel wire cables were fastened to the third bottom-chord panel point from the south end, carried over the top of the supporting column at the south end and down to an attachment at one of the wall columns. By tightening up on these cables this bottom-chord panel point was raised 1 in., providing the required camber of 1½ in. at the center of the truss.

After the proscenium truss was in place, the guy derricks at the stage end of the building were used to erect the gridiron framing and the roof girders over the stage. Some of the roof girders had a span of 63 ft. and weighed 25 tons.

Longitudinal Trusses—The 123-ft. span of the longitudinal trusses made substantial falsework necessary. This falsework was designed so that it could be used as a working platform as well as to support two additional derricks for the erection of parts of the trusses not within reach of the four derricks located at the ends of the building. This falsework, as previously stated, consisted of a bay of steel columns and girders, three tiers or six stories high, borrowed from the upper floors of the 69-story RCA Building.

To support the falsework, steel framing was placed on top of 22 of the auditorium floor columns, which had been ordered 3 or 4 ft. long and of equal length, for this purpose. These columns, which support the sloping floor of the auditorium, are of various lengths in the completed theater, hence the necessity for ordering them of uniform length. After the staging had been removed the tops of these columns were flame-cut to ¼ in. above the floor level. An area 2 ft. square around each column was kept open for this purpose when the concrete floor was poured.

As shown in Fig. 5, this falsework was in reality two towers, the division being along the center line of the theater. Each tower was of such length as to serve as a support for two trusses, T2

Fig. 3—Warping a top chord section of one of the longitudinal trusses into position for raising. Derrick at right lifted member from a truck in the street. Falls of raising derrick at left, which rests on steel falsework tower, are being transferred to a hitch at the center of the chord so that other derrick may be released.

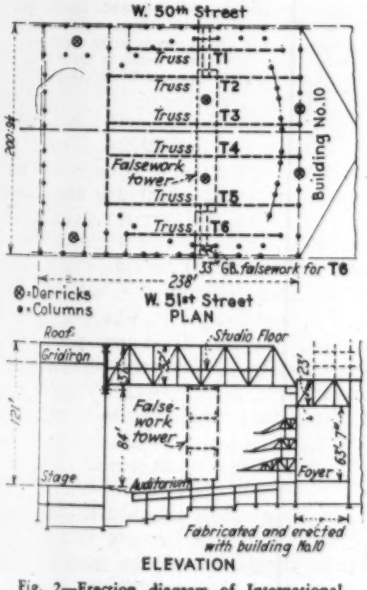


Fig. 2—Erection diagram of International Music Hall in which seven roof trusses, involving about 1400 tons of steel, and long cantilever balcony girders presented a construction problem of unusual magnitude.

(231 tons) and T3 (216 tons) on the south tower and T4 (216 tons) and T5 (231 tons) on the north tower. Supports for the shorter outside trusses, T1 and T6, each weighing 98 tons, were provided by temporary girder beams (Fig. 4) spanning between the falsework towers and the permanent steel already erected along the walls of the theater. The 20-ton derricks were placed in the exact center of the falsework towers and guyed to the corners of the towers and to outrigger beams.

The erection scheme as planned and carried out was first to erect the bottom chords of trusses T1, T2, T5 and T6. Each of these chords was hoisted in two pieces and spliced near the center. Beams were then placed between T1 and T2 and T5 and T6 to carry a planked working platform (Fig. 6). The two center trusses, T3 and T4, were then erected, riveted and swung. Finally, trusses T5 and T6 were completed and swung, and truss erection was finished by erecting the web and top-chord members of the outside trusses T1 and T6. By this procedure, each falsework tower was required to carry only one complete truss, the bottom chord of another and a small part of the weight of the bottom chord of the outside truss.

Each of the four longitudinal trusses was carried on the falsework tower on a timber grillage and two hydraulic jacks. To provide the necessary camber in the truss and to assist in making the final connections between the closing top-chord members and the web members, the jacks were supplemented by four yokes, as shown in Fig. 5. These yokes were equipped with two 25-ton screw jacks whose operation took up the sag in the bottom chord. The required camber at the center of these long trusses was $2\frac{1}{2}$ in.

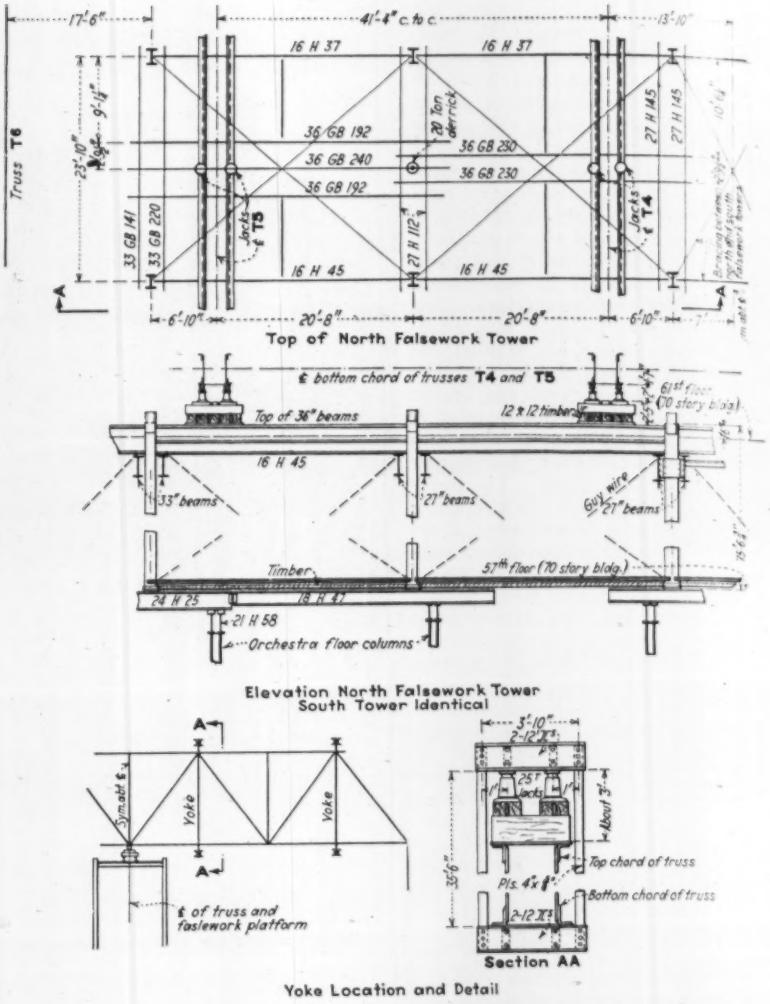


Fig. 5—Falsework tower and yokes used in erecting the longitudinal trusses. Falsework tower consisted of a bay of steel columns and girders from the upper stories of the 69-story RCA Building across the street. Yokes used to assist jacks on falsework tower in placing necessary camber in trusses of International Music Hall.

Sound Theater

The roof-truss system of the Sound Theater is not as heavy as that in the International Music Hall, but it is, nevertheless, substantial. Six transverse trusses are involved (Fig. 7), T1, in the rear, having a span of 140 ft. and weighing 120 tons, T2, T3 and T4 having spans of 128 ft. and weighing 65 tons, T5 having a span of 120 ft. and weighing 60 tons, and T6, the proscenium truss, having a span of 70 ft. In order to save falsework cost, trusses T2 to T5 inclusive were assembled on the floor and raised into place complete, and it is in these operations that principal erection interest lies.

All other steelwork, including trusses T1 and T6, was erected before these truss-raising operations were begun. In general, the auditorium and stage are surrounded by one bay of tier steelwork, the trusses being carried on the inner columns of the bents. This steelwork was erected to its full height by means of five guy derricks in the usual manner (one 11-ton derrick in each corner of the theater and one 20-ton derrick in the center at the rear). In erecting the proscenium truss, T6, it was assembled in place by the guy derricks standing in the front corners of the theater at the level of the gridiron over the stage. The bottom chord of this truss, which came to the job in two pieces, was first spliced on the floor and lifted into place. In this condition it had a considerable sag, and in order to introduce a camber before the dead load of the web members and top chord was added, an inverted king-post truss arrangement was installed beneath it. This consisted of two $1\frac{1}{4}$-in. wire cables attached to the ends of the chord and brought down to a clevis attachment at the center of a girder over the proscenium opening, about 35 ft. below the bottom chord of the truss. A plumb post was placed between this beam and the bottom chord

Fig. 4—Half of bottom cord of truss T1 in place on temporary beams spanning from falsework tower at left to building steel at right in International Music Hall.

Fig. 6—Building an erection platform between the bottom chords of trusses T5 and T6. Derrick at left rests on setback of adjacent 31-story building, while derrick at right, handling beam, is on falsework tower of International Music Hall.

of the truss at the center. By tightening the cables with turnbuckles the center of the girder was raised, in turn causing the plumb post to raise the bottom chord of the truss into a camber of about 3 in. The assembly of the truss was then completed by the guy derricks.

The truss in the back of the theater, T1, was too heavy to be erected complete and therefore was assembled in position by the three guy derricks standing on the steelwork at tier 5, or the third mezzanine level.

As stated, the four remaining trusses were lifted into place complete. Using the guy derricks on the steelwork above, each truss was assembled in an upright

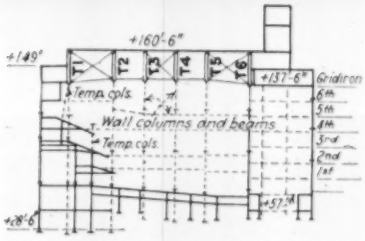
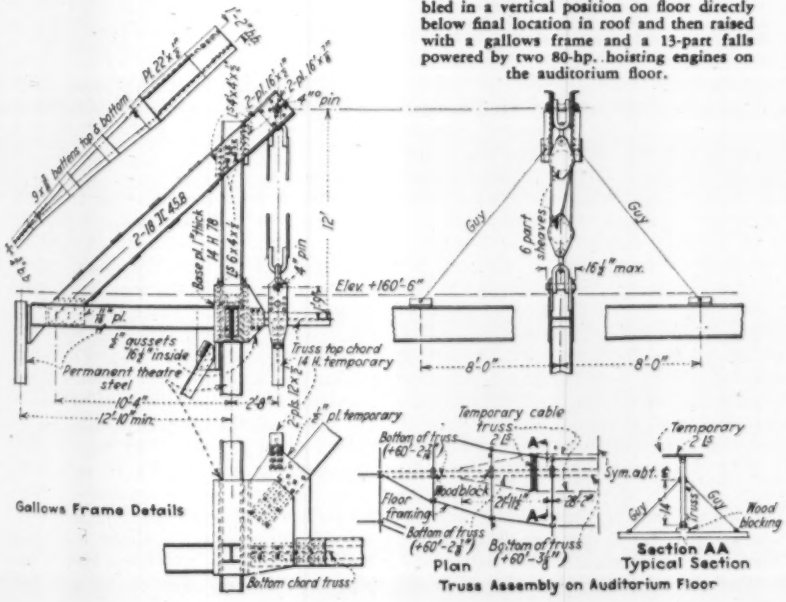


Fig. 7—Erection diagram of Sound Theater. Trusses T2 to T5 inclusive, weighing about 65 tons each, were riveted on the floor of the auditorium and raised into place complete.

position on the floor (Fig. 8), directly beneath its final location in the roof. Wood blocking was placed on the floor at each panel and varied in height so as to place the proper camber in the bottom chord. Some extra beams were also required to distribute the heavy load concentrations over the auditorium floor. Web and top-chord members were added and the truss was entirely riveted. In order to stiffen the trusses during lifting, two pairs of angles, back to back, were placed transversely across the top chord, and cables were drawn around them (Fig. 8) to form a horizontal truss.

Fig. 8—Sound Theater trusses were assembled in a vertical position on floor directly below final location in roof and then raised with a gallows frame and a 13-part falls powered by two 80-hp. hoisting engines on the auditorium floor.



Two 80-hp. electric hoisting engines were placed on the floor of the theater near the back to provide the lifting power. Care had to be exercised to keep the trusses level as they were being hoisted, since there was only about 6-in. clearance with the supporting columns. As the trusses neared the top, the sheave blocks had to pass between the gusset plates, shop-riveted to the column to take the bottom-chord joint of the trusses. To accomplish this, the edges of the steel sheaves were burned off.

By means of this arrangement the trusses were lifted vertically into place. After each truss was landed and made fast, the gallows frames were moved to the next truss position, and the operation was repeated. The four trusses were assembled on the auditorium floor and erected complete in ten days. Raising time for each truss was about 10 min.

Architects for the theaters were the firms of Reinhard & Hofmeister, Corbett, Harrison & MacMurray, and Hood & Fouilhoux. H. G. Balcom and Associates designed the steelwork. Erection was carried out by Post & McCord, New York City, Aubrey Weymouth chief engineer, and William H. McCord superintendent of erection. Jack Wolfe was foreman on the International Music Hall and Sam Lowman and Fred Hagstrom were foremen on the Sound Theater.

Rubber Roads in Europe

Experiments have been carried out in Amsterdam in Holland with a new road-surfacing material composed of powdered rubber mixed with asphalt. A special process for producing powdered rubber has been developed there. It is claimed that the new compound provides a noiseless, non-skid surface and that any roads so surfaced can carry traffic within an hour of the application.

Skyscraper Steel Erection in the RCA Building

Tonnage of 58,500 is largest in any building—Outrigger relay platforms required at 450-ft. level—Special connection procedure for group of silicon steel columns

ERECTION of the 58,500 tons of steel in the RCA Building of Rockefeller Center in New York City developed little new in the art of tall building construction but afforded another illustration, as did the erection of the Empire State Building by the same steel contractor, of the manner in which a well-conceived plan of attack, using modern equipment, can average four floors of steel per week, regardless of the area covered by the building. Below the 13th floor the area covered by the RCA Building is about 168 ft. wide by 535 ft. long. Above this elevation the tower dimensions are in general 103x302 ft., with no setbacks of any appreciable size. These areas definitely fixed the number of derricks required for the two stages of erection. The fact that the steelwork in the west third of the building was special in some particulars and was only about 16 stories high at the maximum also suggested that the erection of this portion, known as section No. 9 (Fig. 4) be carried out on a schedule distinct from that used for section No. 1. Finally, the fact that there were no setbacks on the tower that could be used to support relay derricks and serve as intermediate landings for steel being hoisted to the upper part of the tower, dictated the use of specially designed relay platforms carried on outriggers from the face of the tower at the 33d floor.

Fig. 1—Erecting one of the heavy two-story column sections in the RCA Building.

The erection diagrams in Fig. 4 indicate the derrick layouts for the three erection divisions on stages: (1) below the 13th floor in section No. 1; (2) above the 13th floor in section No. 1; and (3) in section No. 9. Stages 1 and 3 were carried out simultaneously, although progress in each was at a different rate after the first few floors had been placed.

Considering section No. 9 first, the base plan was about 168 ft. wide by 230 ft. long. Four derricks were provided, each to erect steel in one-quarter of this area. Two of these, both of 20-ton capacity, carried up the 16-story office portion on the Sixth Ave. front. The other two derricks, one of 20-ton and one of 30-ton capacity, erected the 12-story studio section. The trusses and long-span rolled girders in this section slowed down erection progress compared with the office-building portion but otherwise presented no complications. Column steel from other parts of the building formed the falsework upon which the trusses were assembled. Splice plates bolted to these columns and extending about 8 in. above their tops confined 8x10-in. timbers which, with wood wedges to provide the necessary camber, supported the long roof trusses at two panel points.

The large area covered by the lower part of section No. 1 required the use of eight derricks, four along either side of the building. They were set in about 50 ft. from the building lines so that with their 75-ft. booms they could pick steel directly from trucks in the street below.

The setbacks along the north and south faces of the building occur progressively from east to west, the first being at the 3d floor and the last at the 12th floor. Accordingly, as erection progressed above the setbacks and the building became narrower, each pair of original derricks was replaced by a single derrick until, above the 13th floor, four steel-setting derricks along the center line of the building had replaced the eight derricks with which steel erection began.

For the floors between the 13th and 37th, steel was picked from trucks in the street by relay derricks on the 7th-floor setback on the north face of the building and on the 12th-floor setback on the south face of the building, respectively. These derricks landed steel on the setback storage areas, as shown in Fig. 4, from which it was picked by the setting derricks on top of the building.

At the 37th floor, about 450 ft. above the sidewalk, the amount of cable on the hoist drum of the setting derricks amounted to over 2,000 ft. and taxed their capacity. Accordingly, relay platforms were required and were located at the 33d floor, 400 ft. above the street. No setbacks being available, special outrigger platforms had to be provided.

Fig. 2—Billets placed on edge and milled **to bear on the coverplates spread** the column **load on the foundation.** The largest **of these wing billets is 8** ft. tall, about **3¼ in. thick and 14 ft. wide at the bottom.**

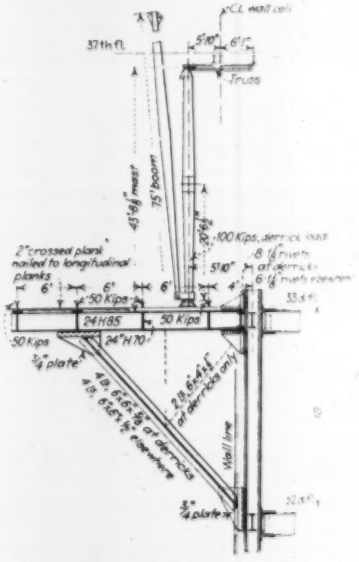


Fig. 3—Outrigger platforms to which steel **was hoisted from street** and then **transferred to falls of erection derricks** on the **building above.**

Location of these platforms is indicated in one of the plans of Fig. 4, while some of the details are given in Fig. 3. For that part of the building above the 33d floor, therefore, steel was picked from the street by a 30-ton derrick on each relay platform and handled from the platforms by the four setting derricks, which proceeded to erect steel to the top of the building.

Hoisting engines for the setting derricks were placed in the basement until four floors of steel were erected. They were then shifted to the 3d floor, in which location they were operated until steel reached the 37th floor. For erecting the building above the 37th floor, the hoisting engines were shifted to the 33d floor.

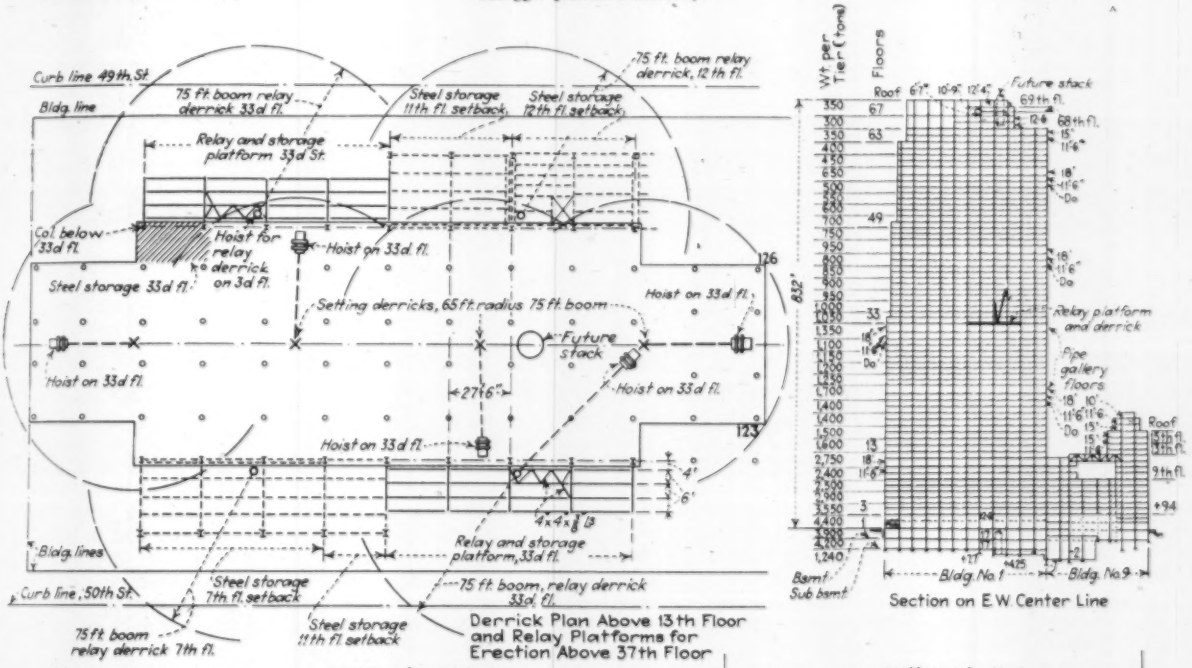
On the Empire State Building, where long lifts were required, many sheave bushings were burned out. On the RCA Building roller-bearing sheaves were substituted on the snatch blocks, and trouble with burned-out bushings was entirely eliminated.

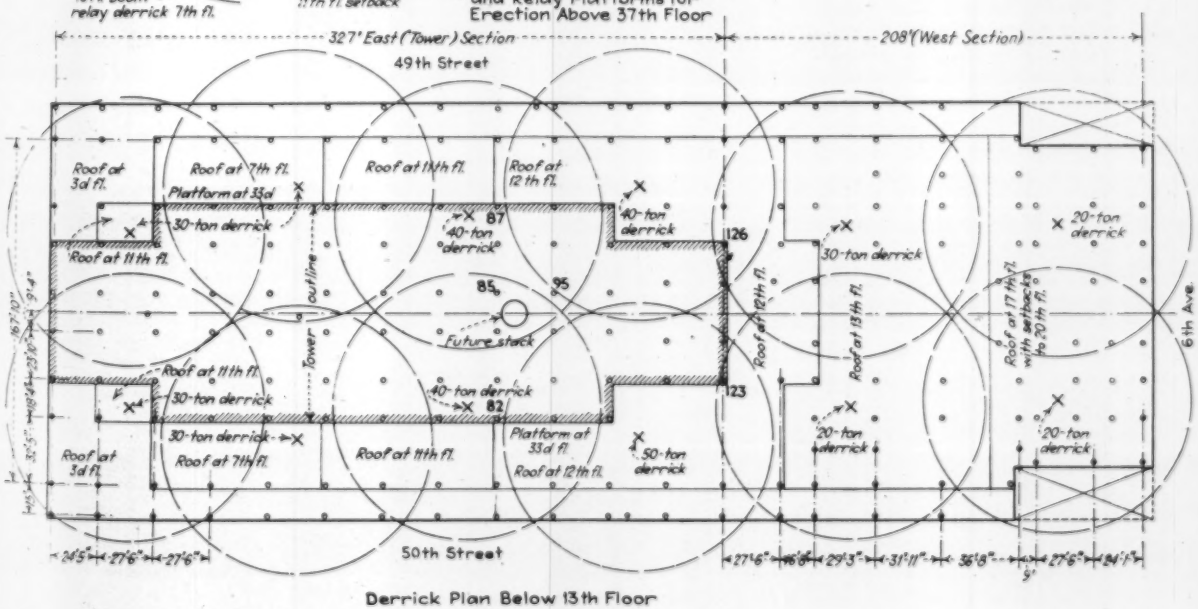
Details of erection procedure were unusual in only one instance. As stated in the design description (*ENR*, Nov. 17, 1932, p. 587), the four silicon steel columns around the future stack were fabricated $\frac{1}{32}$ in. per story longer than the adjacent carbon steel columns, while the floor beam connections were detailed as though the beams were level.

The method of erecting these beams was to rivet completely the end of the beam connecting to the carbon steel column, leaving the other end loose. Then by means of cable and turnbuckles, the loose end was raised until it could be connected to the silicon column. The initial stress in the connection was then great enough that shortening of the silicon steel column under load would not loosen the connection enough to impair its efficiency for transmitting wind loads.

The structural design of the RCA Building was made by H. G. Balcom, and associates, with J. L. Edwards in charge. Hegeman-Harris Construction Co. was the contractor. Steel erection was by Post & McCord, and fabrication by the American Bridge Co.

Fig. 4—Steel-erection diagrams for RCA Building. A greater steel tonnage was required than in the Empire State Building. Erection was complicated by lack of setbacks to use for relay platforms, making outrigger platforms necessary.





Old Tunnel Demolished With Trains Running

Pressed-steel liner plates form roof over trains while daylighting the Delaware & Hudson Railroad tunnel at Whitehall, N. Y., in service since 1850

IN THE process of eliminating restrictive and dangerous traffic conditions on its lines through Whitehall, N. Y., the Delaware & Hudson Railroad has removed one of the oldest of the American railway tunnels. This tunnel, a little less than 1,000 ft. long, is replaced by open cut and, at the south end, by a box section of concrete and steel about 241 ft. long. In connection with the tunnel work there has been a general revamping of the railway lay-out through the town, including street changes and grade-crossing elimination. These operations have not gone beyond usual practice, but the tunnel improvement involved interesting procedure.

Old tunnel

The Whitehall tunnel was constructed in 1850 when the Rensselaer & Saratoga Railroad was carried through to Whitehall to provide rail connection between the Hudson River and Lake Champlain. This date takes it beyond the pioneer era of railway tunnels in America (perhaps two-score had been built previously) but places it well among the earliest works of the following generation. Truly speaking, however, the Whitehall tunnel represents its era of tunnel practice only in section and lining construction. It was not constructed by tunneling. According to records the hill was cut through by an open excavation in which the tunnel structure was built and then covered over, restoring the hill. In making the excavation for the present structure, buried remnants of the trench bracing, used 83 years ago in the old cut, were uncovered.

As constructed, the tunnel was 975 ft. long. It is stated that doors of wood were provided at each end "to keep out frost." Fig. 1 shows the original section and the changes that were afterwards made. From *C* to *D* and from *E* to *F* are the original sections. They consist of low bench walls of stone masonry carrying a slightly pointed horse-shoe arch of brick masonry 30 in. thick. The dimensions varied, it will be noticed, but in general gave only small single-track clearances. In fact, modern large cars could not pass the tunnel, and the locomotives that have operated through it had cut-down cabs. This restriction, combined with the bottle neck formed by a single-track tunnel in a double-track line, prompted the present reconstruction.

Meanwhile the old tunnel had been rebuilt in several parts, as shown by Fig. 1, as local deformations or failures developed. In 1873, 80 ft. of the tunnel from *B* to *C* was rebuilt. This part rested on soft blue clay, and in reconstruction a heavy timber grillage was built, as shown, to carry the masonry. Also it was made much stronger by massive stone masonry side walls and a semicircular roof arch of brick 2½ ft. thick. It will be noted that in building the new box section over this soft area a very heavy construction was adopted.

A dozen years later, in 1885, a 92.6-ft. section from *D* to *E* was rebuilt by replacing the old brick arch with heavier masonry and by giving it

Fig. 1—Outline plan and sections of tunnel constructed in 1850 to carry the Rensselaer & Saratoga Railroad through the hill at Whitehall, N. Y., and connect the Hudson and Champlain valleys by rail.

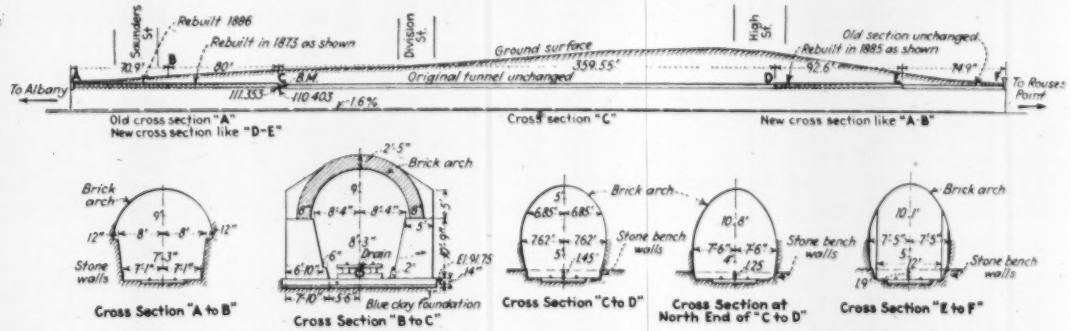


Fig. 2—Section of subway replacing 241 ft. of south end of old tunnel in wet squeezing clay and carrying Saunders St. (Fig. 1) over the railway.

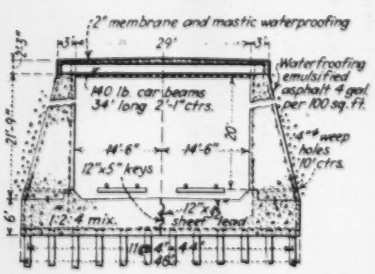

2" membrane and mastic waterproofing
Waterproofing emulsified asphalt 4 gal. per 100 sq. ft.
140 lb. car beams 34' long 2'-1" ctrs.
4"ø weep holes 10' ctrs.
12"x5" keys
1:2:4 mix.
12"x10" sheet lead

Fig. 3—Representative cross-section of open cut, shown above, which replaces old tunnel north from the subway section shown by Fig. 2 at left.

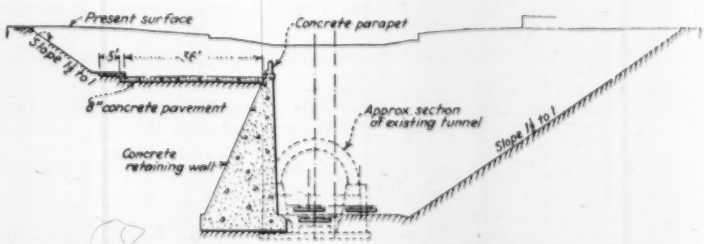


Fig. 4—Built-up strut of two timbers designed to act as a unit by nailed diagonal sheathing on both vertical faces and by heavily bolted splices.

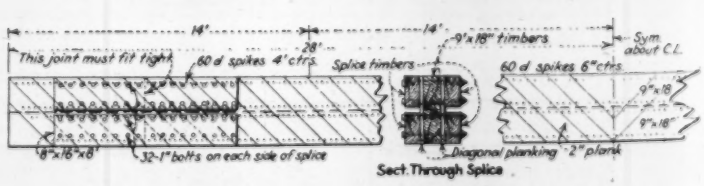

9"x18" timbers
Sym. about C.L.
This joint must fit tight
60 d spikes 4" ctrs.
Splice timbers
60 d spikes 6" ctrs.
32-1" bolts on each side of splice
Diagonal planking 2" plank
Sect. Through Splice

Fig. 5—Horizontal struts and raker bracing between lines of sheetpiles driven on each side of emplacement zone for new track and retaining structures.

greater clearances. A year later section *A* to *B* was reconstructed as shown. As these new sections were built the floor of the original tunnel was dropped, as shown by Fig. 1, to give greater height clearance. Many small repairs had been made from time to time on the brick, which would naturally disintegrate in an arch as old as this one—83 years.

Summarized briefly, the problems confronting improvement, so far as the old tunnel was concerned, were the old structure as described, which must not be closed to traffic, several streets crossing the hill over it, and several buildings on the hill adjacent to the tunnel line. As stated, the reconstruction plan was worked out in connection with a plan of general street and track revision and grade-crossing elimination.

New structures

The reconstruction plan for the old tunnel was a two-track open cut through the hill, except for 241 ft. at the south end (south side of Saunders St. north 241 ft.), which was to be double-track box subway to carry Saunders St. (Fig. 1) and a building nearly overhead. Specifically, from the south portal of the old tunnel to Saunders St. is open cut, with retaining wall on the west side and the natural slope on the east side; then follows the 241-ft. subway section and finally open cut to the north portal of the old tunnel. This long north cut has a retaining wall along the entire west side; on the east side a wing wall runs out 60 ft. from the north portal of the subway and then is sloped earth bank, as indicated in Fig. 3.

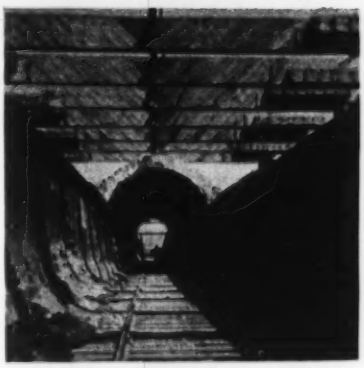


Fig. 6—Trench bracing of built-up double-timber struts where rakers could not be used. Old tunnel is in background.

Both walls and subway were very heavy structure, as shown by the sections Figs. 2 and 3. At the maximum height the west wall was about 50 ft., and the fill carried a 36-ft. paved street with curb close against the top of the wall. The base width was 55 per cent of the height. The section shown by Fig. 3 is about at *D*, Fig. 1. The subway section, Fig. 2, was remarkably heavy to give stiffness on a soft clay foundation.

Construction methods

The unusual task of construction was that of removing the old tunnel without interrupting the regular service of seventeen trains a day. The first operation was to make a shovel cut through the cover over the tunnel to a depth of about 20 ft. above the base of rail. Then a row of heavy steel sheetpiles was driven on each side just outside the lines of the emplacement for the new structure—retaining walls and subway section. Shovel excavation was then carried down to the top of the tunnel arch. The rows of sheetpiling were then braced apart.

Two styles of trench bracing were employed. For most of the length horizontal struts 10 ft. apart were carried across the trench at the top and alternated with rakers, which were given as steep a pitch as possible and still clear the trains using the tunnel. The rakers were set after the roof arch had been broken down. Fig. 5 indicates this arrangement of bracing. Near the south end the use of rakers was not possible. Heavy bracing was necessary, however, because of the wet and squeezing ground. Special built-up struts were used, as shown by Fig. 6. These were spaced 10½ ft. apart and braced apart by lateral struts about 12 ft. apart. The construction of the built-up braces is shown by Fig. 4; they were designed even to the spacing of the nails.

With the trench braced, a clamshell unloaded the haunches, exposing the arch, as indicated by Fig. 6 and by

Fig. 7—Breaking down old tunnel roof arch onto a shield of steel liner plates that protected trains and reduced inside clearances only 2 in.

Fig. 8—End view of shield, showing scaffold for taking down liner plates at the rear and erecting them in front as the arch demolition progressed.

Figs. 7 and 8 where the cut was shallow and required no bracing. The tunnel masonry was removed in two stages, first the roof arch and then the side walls. To do this without stopping train service called for special equipment and procedure. The roof arch had to be broken down onto a centering or shield that would occupy as little space as possible, and selection was finally made of steel liner plates, which reduced the all-around section only 2 in. The arch of liner plates took footing on the stone side walls or, in the narrower old sections, on posts notched into the brick side walls. This center or shield was extended by taking down plates from behind and setting them up ahead. The shield was 50 ft. long. Figs. 7 and 8 show clearly the method of breaking down the arch with jackhammers.

After the arch had been removed for the full length, the track was shifted as close as possible to the west wall, and a row of short sheetpiles was driven along the center line of the cut. The east wall was taken out and excavation was made for the new wall in 10-ft. sections. As each section was excavated the foundation and wall were put in. The track was then shifted east and the west wall constructed.

In all the work of demolition and construction care had to be exercised to protect the train service, but there were no particular complications. Only one building required underpinning. A templet car was used to make sure that train clearances were maintained. While the tunnel section was the exceptional part, all the work of track relocation, street changes, bridging and grade-crossing elimination carried out by the railway constituted a city improvement of real importance.

James MacMartin, chief engineer, had direction of the work for the railway, with Edward Penrose as resident engineer. The contractor was the Hocker-Moon Construction Co., Cleveland, Ohio, with Walter Kipf as superintendent.

Preparing for River Diversion at Hoover Dam

A first-hand glimpse of the work recently centered at the upper portals of the diversion tunnels and an outline of the operations required to complete river diversion

TWO WEEKS ago an observer standing at a point of vantage near the upper portals of the diversion tunnels in the Black Canyon of the Colorado River was able to look upon a scene of concentrated activity—preparations for the river diversion, which subsequently was begun on Nov. 13 by blasting out the arch cofferdams and rock barriers at the upper portals of the two tunnels on the Arizona side. That event marked the close of the first stage of construction of Hoover Dam. The following sketch describes the diversion operations as viewed on Oct. 22 and outlines the method of completing the turning of the river into the tunnel. Now that diversion has actually taken place, some of the facts referred to in the future tense should be changed to the past. This transposition can easily be made by the reader.

On Oct. 22, then, the point of observation is the Nevada end of the timber trestle bridge spanning the river immediately downstream from the portals of the inside tunnels. This temporary structure—the third since the work started—is replaced and used during periods of low flow in the river; at other times the steel suspension bridge which is above high-water level is used.

Looking downstream, one sees a dike of dumped rock which has swung the river over to the Arizona side of the canyon and made available an area more than 100 ft. wide by 700 ft. long for cofferdam excavation. In this area two shovels and two draglines, including a 5-yd. dragline moved in temporarily from the gravel pit, are filling a line of trucks (Fig. 1) that move back along the road on the dike to dump into

Fig. 1—The upstream cofferdam site after 80,000 cu.yd. of excavation had been removed. The river is at the left-hand (Arizona) canyon wall and its surface elevation is almost 30 ft. above the shovel and tractor in the foreground.

Fig. 2—Looking down on the upstream cofferdam site from the canyon wall on the Nevada side, shortly after the diverting dike had been completed and 3 weeks before the view shown in Fig. 1 was taken. The 5-yd. dragline is starting excavation at the upstream toe. A temporary rockfill dam will be built by dumping from the trestle to turn the river into diversion tunnel No. 4. The line on the Arizona canyon wall outlines the permanent diversion dam.

waiting trains. At less than one-minute intervals these trucks continue to roar out of the excavation, day and night. More than 80,000 cu.yd. of river sand and gravel has been removed since the work started the first part of October. Excavation over the area will be continued to firm consolidated material before the earthfill cofferdam is started. On the canyon walls (Fig. 2) can be seen the painted slope lines marked by bureau engineers to define the slope lines of the cofferdam where it meets the canyon walls.

One 12-in. centrifugal pump is holding down the water in the sump at the upstream toe line; the head of water against the rock dike at this point is about 30 ft. Although some small streams of clear water can be seen coming through the dike, the tightness of the temporary dam is notable. One possible explanation is the silting of the river bed at low stage, which tends to seal the channel.

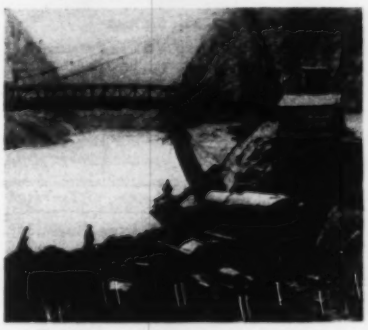
A small jackhammer crew is plugging some of the boulders in the site which were too large to handle. Work on the upstream cut off of steel sheet piling had not been started, although the excavation had been carried especially low at the toe for this coming operation. However, enough of the site will be available and ready so that extensive backfilling operations with the rolled earth material will start within a week.

Looking farther down the canyon to the actual dam site (Fig. 3), the observer sees extensive slopes of waste

Fig. 3—Looking down the canyon, the results of wall scaling and outlet tower excavation are indicated by slopes of waste rocks along the water line. The tiny speck over the gorge is a cableway skip taking a crew to the Arizona side.

rock accumulated from the scaling operations and outlet tower excavation high up on the walls. A cableway skip with a crew of men can be seen crossing the gorge. This aerial transfer, faintly visible in the photograph, Fig. 3, takes the crews over to scaling operations on the Arizona side, saving them

Fig. 4—This equipment is removing waste rock from in front of the concrete arch cofferdam protecting the portal of tunnel No. 4 in preparation for diversion of the river.



a 6-mile ride over steep construction roads down into the canyon and up again.

Rock fragments roll down and splash into the river continuously, and at the noon lunch hour shots on both sides bring down hundreds of tons of rock and fill the entire gorge with dust clouds. Scaling operations, because of their hazardous nature, are carried on only during the day shift; at night, therefore, it is possible to reduce the accumulation of waste by shovel and truck, since it must be moved eventually and it now tends to constrict the river channel and raise the water level.

Turning now to look across the bridge toward the Arizona side of the canyon, the eye follows a line of mixer trucks up a steep grade, over the top of the arch cofferdam that protects the portal of tunnel No. 3. The trucks disappear into the bore, where lining operations are in progress. A little farther upstream a shovel is removing the waste rock dump from in front of the arch dam at the portal of tunnel No. 4 (Fig. 4). Trucks from this excavation roar across the bridge and swing into line with the ones from the channel work on their way to the waiting trains. This concrete dam in front of tunnel No. 4 has been drilled for shooting, and in the event of a sudden rise in the river it could be removed at once if necessary to protect the work under way in the cofferdam site.

Actual turning of the river flow from the channel into No. 4 tunnel, the first one lined and grouted, will be a simple procedure. Removal of the waste from in front of the portal and shooting out the temporary arch cofferdam will open the tunnel for the river flow. Since the invert of the tunnel portal, at El. 640, is several feet below river level, this operation will automatically start the diversion of the river. Diversion will be completed by dumping waste rock from the timber trestle to form a temporary rockfill dam. Such arrangements will be sufficient for upstream diversion during the present low-flow season and will be supplemented by the rapid construction of a rock barrier at the lower end of the dam site. This lower rock barrier will form part of the downstream final permanent cofferdam, at the lower end of the construction area, and is called for in the design to prevent erosion of the lower cofferdam by backwash from the diversion tunnels. These arrangements will complete actual diversion of the stream into tunnel No. 4. Present plans call for finishing both permanent cofferdams during the coming winter months of low flow. The other tunnels will then be ready for use during the spring flood season. When they are in action the actual dam site will be accessible for year-round work.

Directly upstream is the steel suspension bridge used during periods of high water as the crossing providing

access to the Arizona portals. It is not in service at the present time because the timber trestle at a lower elevation is more convenient. Swinging the eye beyond the bridge, one finds that the canyon wall on the Nevada side obscures the concrete mixing plant, but the trucks from this plant may be seen coming through the first of the two railroad tunnels driven by the contractor to reach the dam site and now used exclusively as a vehicular tunnel. The railroad, at present, comes around outside the tunnel on fill and ends at a loading dock for the trucks near the portal of diversion tunnel No. 2. Three seven-car trains averaging 175 cu.yd. per trip operate between this terminal and the area of fill about a mile upstream.

Near by on the Nevada wall of the canyon, steel-erection crews are at work on two truss spans that will carry the railroad line (after it is moved into the tunnel) between the railroad tunnels and over the portal of diversion tunnel No. 2. This final location of the railroad grade will allow its extension to the actual dam site, where it will serve extensively for removal of excavated material at the site, and finally, for bringing in concrete for the structure. A temporary timber trestle is being built to extend the present railroad line beyond the present loading dock to provide for transferring the incoming earthfill material to trucks for placing in the cofferdam site.

Trains are now changing at the loading dock, and during the time interval required for backing in a new train the trucks have accumulated and are waiting to dump half a trainload into the cars as soon as the train is spotted. The rest of the load is soon added by the endless line of trucks, and the train starts upstream to the dumping area. Within a week the trains will be bringing in earthfill for the cofferdam on their down trip.

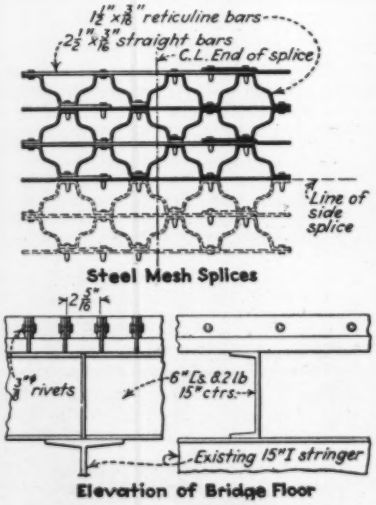
All is organized confusion. In addition to the constantly active trucking fleet, cars carrying special crews and officials are always on the move. The fast pace of the men in the construction crews speaks well for the excellence of the construction force and the organization directing the work. The multitude of incidental operations required on this small section of the entire job is astonishing. A "grease monkey," as the shifts change, gives the trucks lubrication in vital spots without appreciably stopping their progress. The ever-present welder with equipment in a small car arrives with a rush to effect a minor, but important, repair operation, and moves on again. Overhead a cableway across the gorge brings a huge section of form for the tunnel-lining work from the Arizona side so that it can be set up and used in one of the Nevada tunnels. The erection crew for the bridge truss adds an incongruous touch to the work of building a dam. Knots of officials gather and disperse. Trucks continue to roar past in endless procession. Near by is an emergency first-aid hospital with a stretcher hung outside the door—a grim reminder of the battle.

Shadows begin to dim the bottom of the canyon and lights appear. Others take up the various tasks as the day workers leave. The trucks continue to roar, and the work goes on into the night.

Open-Mesh Steel Deck for Seattle Bascule

REMODELING of the University Ave. bridge in Seattle, Wash., to provide it with more roadway capacity, includes the novel expedient of an open-mesh steel deck on the bascule span. The decking, which with its support of 6-in. channels on 15-in. centers weighs 21.2 lb. per sq.ft., effects a weight saving of some 16 lb. per sq.ft. over the lightest alternative design made, and permits adding extra vehicle lanes outside the bascule trusses without strengthening the trusses themselves. The unit bearing on the trunnions will be increased only from 1,540 to 1,684 lb. per sq.in. as a result of the proposed changes. In addition to alterations in the bascule span, new approaches 58 ft. wide will be constructed.

Seattle has had previous experience with a somewhat similar deck on the Spokane St. bridge, although in this case a relatively light steel mesh was laid on a timber subflooring and filled with asphalt, which was lightly depressed to bring out a surface outline of the steel (*ENR*, Sept. 10, 1931, p. 419). According to John A. Dunford, assistant bridge engineer of Seattle, two years' experience with this floor has shown it to be less slippery when wet than other types of light bridge floors known to his department, and also reveals that it stands up under severe traffic. Mr. Dunford states that Walter E. Irving, of the Irving Iron Works Co., Long Island City, N. Y., urged the adoption of an open-mesh floor in 1928, but that the bridge department postponed using it until some experience had been gained with the less radical change from past practice exemplified by the Spokane St. bridge installation.



Details of open-mesh flooring for University Ave. bascule bridge in Seattle, Wash. Mesh is field-welded to channels, which are in turn welded to the bridge stringers.

In the case of the University Ave. bridge, early studies had discouraged the idea of widening the bascule span, in view of the extensive changes in foundations, trusses and counterweights that would be required. Any considerable load added to the river arms would have to be counterweighted with about twice its weight, while the cumulative increase in load on the trunnions would be almost threefold. The open-mesh steel flooring to replace the existing roadway materials and to pave the added traffic lanes was the solution.

The plans as worked out make no fundamental changes in the structure other than the improvements to the roadway and the rebuilding of the operators' houses; some extensive changes around the top of the bascule piers are necessary to accommodate the roadway changes. The dead-load stresses in the truss members will be increased 9 per cent, and the live-load stress will be increased about 12 per cent. Inasmuch as the structure was originally built to carry interurban street cars, a loading that will not be realized, it was thought practical to permit the rather small increase in the theoretical loadings for the bridge in view of the fact that snow and ice loads as provided for in the original design may be neglected with the open-mesh floor. Mr. Dunford also states that provisions for wind loads may also be modified somewhat with the use of an open flooring. The accompanying illustration shows the type of deck used. The straight bars run lengthwise of the bridge to prevent side-skidding. A special field splice joins the shop-fabricated panels into a deck that is said to exhibit perfect continuity at all points. It is thought that the openings in the bridge floor will not prove a handicap to traffic, since horse-drawn vehicles are largely excluded by the dense motor-vehicle traffic. Smaller animals, such as sheep, cattle and hogs, are of course usually transported in trucks.

Road Officials Review Progress and Future Problems

Association of State Highway Officials urges research as a means of combating attacks on road funds and arguments for a holiday in highway improvement

Engineering News-Record Staff Report

CURRENT conditions in highway finance and administration received principal attention in the general program of the convention last week (Nov. 15, 16 and 17) of the American Association of State Highway Officials. In all there were six main papers and addresses on road planning, obligations of the road user in financing roads, roadbuilding for unemployment relief, national-park road development, road expenditures as governmental obligations and future directions of highway activity. All technical discussion was closely confined to the separate sessions of the standing committees.

The 1932 record

Figures presented by the executive secretary of the association showed that all federal funds, both regular federal aid and emergency loan money, a total of $181,720,000, were available on July 1. Of this total $61,720,120 was regular federal aid. On Oct. 1 the total had been reduced to $110,438,117, of which $68,362,986 was emergency loan money not contracted. (To date, according to estimates by the Bureau of Public Roads, about $90,000,000 of the loan money has been contracted.—Editor.) The total of 1932 state road contracts for nine months to Oct. 1, was $299,928,482. In considering this figure, it was pointed out, the fact had to be kept in mind that the emergency loan money did not become available until about Aug. 1. Nevertheless, the contracts for nine months of 1932 amounted to about $78,000,000 less than those for the first six months of 1931.

Considering employment, the secretary's figures for the 48 states for August, 1932, showed the number directly employed on state and federal road work to be 330,000. Commenting on relief loans to states from the $300,000,000 provided under Title I of the emergency act the report pointed out that: These funds are to be repaid to the federal government out of future federal funds authorized to the borrowing states for the construction of roads. These loans carry 3 per cent interest, and repayment must begin with the year 1935 or three years before the conclusion of the repayment of the $80,000,000 emergency loan of 1931. The report said:

> The governors of the states may make other provisions for the repayment of this loan, but if these provisions are not made within two years the reimbursements are taken from the regular federal funds authorized for roads. That a day of reckoning is coming is quite evident. The repayment of the funds advanced last year and this year and the loans to the governors for relief will make the final amounts available for roads in some of the states so greatly reduced as to provide a very diminishing road program.

Future problems

Looking ahead of the record of 1932, discussion was centered on future highway trends and necessities. A paper by Henry G. Shirley, highway commissioner of Virginia, called for larger appropriations and expenditures by all governing agencies and warned against growing tendencies to divert road-tax money to other purposes. Grover C. Dillman, highway commissioner of Michigan, reviewed the work done by his department last winter in developing road work for unemployment relief, covering the information given in *Engineering News-Record*, Nov. 10, 1932, p. 561. The development of the state highway departments as planning agencies was reviewed by O. S. Warden, chairman of the highway commission of Montana. Future planning was also the theme of addresses by Roy D. Chapin, Secretary of Commerce, and Ray Lyman Wilbur, Secretary of the Interior.

A definite listing of major problems was made by Arthur M. Hyde, Secretary of Agriculture, speaking for his department as director of federal activities and expenditures for highway development. It was pointed out that present progress had brought roadbuilding interests face to face with these problems:

1. We have come definitely to a period of greatly decreased annual highway income. This results from a lessened income from motor-vehicle licenses and taxes upon motor oils and fuels, from decreased property taxes and from exhaustion of credit to support additional bond issues.

2. We have a very large capital investment which imposes heavy maintenance obligations, maintenance not only in the technical sense but also in the sense of a continuous improvement of facility consistent with our traffic needs, including the reconstruction, widening and the lifting of inferior types to better standards.

3. Our major road system is yet far from completion, and there is need for the improvement of tremendous mileages of secondary or more strictly rural roads.

To meet these problems under the changed conditions, it is necessary that we fashion new methods and new policies, and these may be reached only through the channels of critical review and research. Continuing, the secretary said: "In dealing with this great national subject of highway improvement, I can suggest nothing, I can ask nothing of greater significance than that every highway department shall dedicate itself to a greater and farther-reaching program of research, both economic and physical, than it has ever undertaken in the past. It is not contradictory to state that as the funds for the highway program decrease, the greater should be the funds devoted to investigational reviewing and research that, through the disclosures, the correct policies of management and technical standards shall be constantly adjusted to the needs. Let us know the facts, anticipate the trends,—and knowing the realities, let us face them frankly.

"Those tools which are so sorely needed to build a correct administrative program are detailed studies of statistical records, the establishment of budgets based upon income, and the balancing of maintenance, reconstruction and new construction programs, that will permit the greatest service to the public and that will preserve without depreciation the capital investment that has already been made.

"There is much uninformed propaganda to the effect that larger amounts of this income can be diverted under stress of present conditions to a wide variety of other purposes, including direct relief. Not only do these proposals threaten the relief which is now afforded property taxation through the road-user income, but they will if carried into effect inevitably result in a double loss, first, through the depreciation of the capital investment already made in highways, and second, through the default of interest and principal upon securities already issued. If this should become the effect in any state, to preserve its credit, the state must resort to increased property taxation.

"I cannot too strongly urge upon every state highway department the compilation and presentation of a highway budget, which shall take into consideration all of these existing commitments against the income from the road users, that the state legislatures which are to meet in January of this year shall have before them this information as a guide in the proposed disposition of the income from the road-user sources."

Letters to the Editor

Further Study of Bin Design Needed

Sir:—In "Design Notes on Circular Concrete Bins" in *Engineering News-Record*, Sept. 8, p. 291, Mr. Frenzel aptly concludes that spread bins are not desirable structurally. He mentions that partial failures have ocurred through the strain of excessive moments at the interstice bins. He neglects to point out that it is now common practice to thicken the walls at the springing by forming the interstice side of the springing on a tangent from about the quarter point. The moment diagrams of the paper are evidence of the need for such strengthening.

A fundamental assumption in grain-bin design is that the complete structure is considered to act as a monolith. The soundness of this assumption is open to question when the tanks are separated and connected with thin membranous walls. This is a practice that invites failure where secondary stresses in the membranous walls and in their connections to the tank walls have been unprovided for.

A continuous bulkhead, formed by a row or two of bins around a central paved space, appears to offer economy with more certainty. A practicable roof for such a structure is an interesting problem that begs a solution nearer to the ultimate economy that might be expected.

The modern grain elevator is an example of purity in architectural form brought about by the constant pressure for economy in design. An investment by the speedy builders in a few strain gages and some fundamental investigation in design would probably lead to further economies. Mr. Frenzel is probably of the same opinion.

San Francisco, Calif., Sept. 15, 1932. BYRON CURRY.

Spread Work for Engineers

Sir—The writer wants to endorse the letters of Walter H. Wheeler of Aug. 11 and D. C. Henry of Sept. 1. Since there is a national movement to spread the hours of work, why not extend it to the field of engineering?

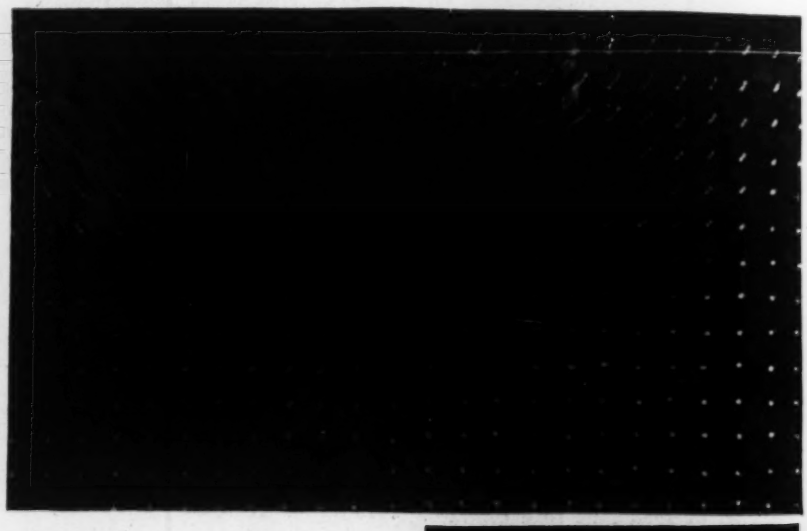
The writer could fill a very large drafting room with competent structural designers and detailers that are unemployed at present and would be willing to work part time, or take the plans of state or county officials and check for redesign on a basis of a per cent of the savings. The writer has seen any number of plans sent out for bids of standard types on which a little time spent on redesign would have made a saving from 8 to 15 per cent. And this with no loss in utility or looks of the structure in any way. He would be very glad to submit any work that he may have under the same terms.

Dallas, Tex., Sept. 16, 1932. F. D. HUGHES, Consulting Engineer.

Soil Action Shown by Model

Sir:—The pictures in your Sept. 15 issue of soil deformation under various types of footings present an interesting method of developing sound conceptions of the manner in which soil behaves under load. The writer has encountered and used somewhat similar methods for obtaining visual evidence bearing on foundation problems.

Fig. 1—Progressive settlement of clay due to plastic flow under pressure of a rectangular block (indicated by white outline).



From the pictures shown in the above issue one gathers that compression or volume change of the soil is an important factor in the settlement of a footing. While this factor, sometimes referred to as consolidation, is admittedly important, its over-emphasis has led to some extent to the disregard for the equally if not more important factor of plastic flow as a source of settlement.

In cohesive and plastic soils, superimposed loads which cause internal stresses greater than the plastic limit of the material result in plastic flow and progressive settlement of the bearing area. When loads exceed this definite bearing capacity limit, consolidation becomes a factor of minor importance. Fig. 1 is a photograph intended to illustrated plastic flow as a source of settlement of a footing. An undisturbed sample of plastic clay was placed in a container with a removable glass face. On the exposed face a rectangular pattern was formed by means of white-headed nails. The experiment was performed by pressing a block of wood into the mass of clay and the movement of the nails was recorded by a time-exposure photograph. The final position of the wooden block which was loaded is obscured by clay that squeezed in between the glass plate and block, but it has been indicated by pencil lines. Such an experiment is thought to be particularly valuable.

Another very interesting method of obtaining visual evidence of even more positive character is shown in Fig. 2. This is a photograph taken by the photo-elastic method by Dr. M. M. Frocht at the University of Michigan (*Trans.*, A.S.M.E. Vol. 54, No. 11, p. 83). A rigid steel die in contact with a Bakelite plate has been loaded and the resulting stress pattern photographed. In addition to the stress variation shown and commonly designated as a bulb of pressure, the stress concentrations at the edge of the plate are of particular interest. The subsidiary pressure bulbs indicate heavy concentrations of stress, and the dark regions of the field at the edge of the bearing area indicate a zone in which the material is approaching the plastic state. This factual evidence of load concentration at the edge of the bearing area is not in accord with a commonly accepted version of pressure distribution which states that

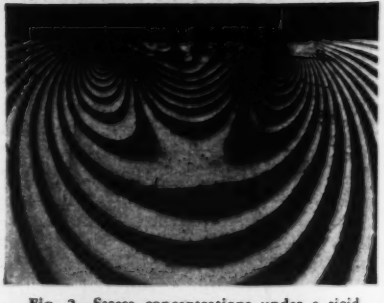


Fig. 2—Stress concentrations under a rigid bearing area shown by the photoelastic method.

the soil pressure on a footing varies from maximum in the center to minimum or zero at the edge.

Evidence of the nature presented in your Sept. 15 issue seems particularly valuable in forming sound conceptions of some of our more intricate problems in behavior of material under stress. Careful study of such evidence should clarify vague and sometimes mistaken conceptions which are frequently encountered in soil mechanics.

W. S. HOUSEL,
Assistant Professor of Civil Engineering, University of Michigan.

Ann Arbor, Mich.,
Oct. 7, 1932.

Model Tests of Pier Action

Sir—In your issue of Sept. 15 an article on "Model Tests of Soil Action Under Footings," pp. 309-11, gives the results of experiments and tests on the action of soil under pier loads and pile driving. It occurred to me that it might be of interest to report a somewhat similar series of tests that was made under my direction in 1912. This work was done in connection with the design of what was then known as Drydock 4, Brooklyn Navy Yard, and had special reference to the central caisson pier foundations, which acted both in bearing and as anchors.

A box with glass front was filled with layers of sand, alternately uncolored and mixed with lampblack. The lowest layer under the sand was powdered cork, to permit ready compression. Load was applied by weights acting on wooden blocks shaped like the proposed pier foundations.

In the adjoining group of views, Fig. 1 shows a loaded pier and the parabolical depressions beneath the pier, indicating that the load at the center was greater than along the edges, following Boussinesy's formula. Fig. 2 shows the same action carried farther to shearing of the soil.

Anchorage action is represented by Fig. 3, indicating the volume of soil that would be lifted, whose weight would give the anchorage effect; a single pier showed the same action as any one of the piers in Fig. 3. However, when the piers were spaced more closely, to represent in true scale their distance apart in the actual work, the effect was as shown in Fig. 4. The inward movement of the outer piers at the bottom indicated the area affected. The angle of rupture over the central pier was about 60 deg. These experiments were a minor part of the testing that was done on ½ scale models.

New York City,
Oct. 7, 1932.

F. R. HARRIS,
Consulting Engineer

Correction

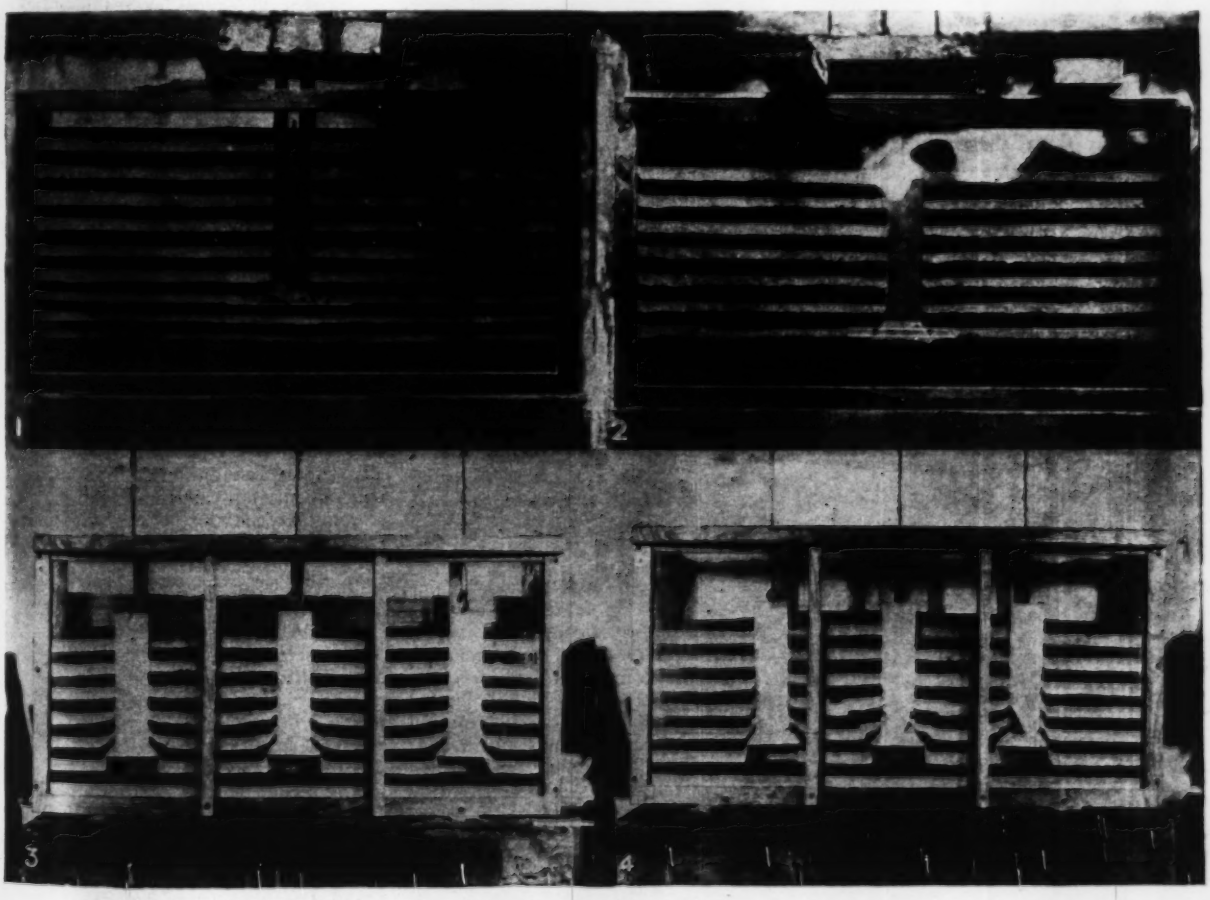
Sir—For thirty years I have been a resident of California. With a feeling of local pride therefore I have read your editorial "Bridges Go West" (*ENR*, October 20, 1932, p. 479). I judge it an oversight that the following sentence occurs in the editorial—". . . with the exception of the St. John's Bridge in Portland, Ore., no structure of more than 1,000 ft. exists west of Detroit."

The Carquinez Bridge near San Francisco was opened to traffic May 21, 1927; it has two main spans each 1,100 ft., a central tower 150 ft. between them, and two anchor arms each 500 ft., as well as an approach viaduct 1,132 ft. long. This makes the total length of bridge 4,482 ft. between terminals, including two spans each longer than the maximum to which you refer. The Carquinez Bridge, of which I was the chief engineer, is still the largest bridge west of Detroit.

C. DERLETH, JR.,
Dean, College of Engineering, University of California.

Berkely, Calif.,
Oct. 27, 1932.

Editor's Note — The statement was written with suspension bridges only in mind, although, as Dean Derleth points out, it is in error as written.



Figs. 1-4—In model tests of pier action to show bearing and anchorage effects for guidance in constructing a drydock foundation, layers of sand in a box with glass front were deformed by loading blocks shaped to represent piers. Downward loading is represented in Figs. 1 and 2, while 3 and 4 show the effect of upward pull on three piers at two different spacings. Note the canting of the outer piers in Fig. 4.

Book Reviews and Notes

A Monthly Commentary on Current Additions to the Civil Engineers' Library

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Building Design

DESIGN OF STEEL BUILDINGS—By Harold Dana Hauf. Cloth; 6x9 in.; pp. 222; numerous line drawings. Published by John Wiley & Sons, Inc. New York and Chapman & Hall, Ltd. London. $2.75.

Based upon the requirements for a third-year course in college architecture, this new book covers the structural problems that are met in designing the modern steel building, both mill and tier type. Chapters are devoted to beams, plate girders and trusses and to connection design. One chapter comprises an excellent brief treatment of wind design of tall buildings. In the concluding chapter the structural design of a small business building is carried through in detail, forming a useful transition and introduction to professional practice.

* * *

British Concrete Design

REINFORCED CONCRETE DESIGNERS' HANDBOOK—By Chas. E. Reynolds. Cloth; 7x10 in.; pp. 297; many tables and line drawings. Published by Concrete Publications, Ltd., London, England. 15s.

Data and methods for designing concrete structures following accepted British practice form the subject matter of this book. It is in some respects a combination text and handbook for Part 1 is devoted to a discussion of loads and pressures and calculating methods while Part 2 is given over to a series of design tables and examples, each example being placed on the page facing the table to which it refers. Part 3 is a bibliography of books on concrete design. In the handbook section, Part 2, complete design information is given for all types of concrete elements and structures such as cantilevers, single span beams, continuous beams, slabs, frames, structures, etc. As reflecting present British practice this book should be of interest to American designers.

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Building Materials and Methods

MATERIALS AND METHODS OF ARCHITECTURAL CONSTRUCTION — By Charles Merrick Gay and Harry Parker, professors of Architectural Construction, University of Pennsylvania. Cloth; 6x9 in.; pp. 639; line drawings and tables. Published by John Wiley & Sons, Inc. New York City and Chapman & Hall, Ltd. London. $6.00.

The authors of this book set themselves the task of preparing a volume that would combine a discussion of the properties of materials generally used in building construction and a description of the methods employed in using those materials. Essentially the work is a textbook, the outgrowth of the authors' experience in teaching these two subjects. In their preface the authors state that the book is not intended to supplant the more detailed works on materials of construction or on methods employed in the use of masonry, steel, reinforced concrete and other types of construction. The book is divided into two parts—materials of construction and methods of construction, with natural subdivisions. Physical properties, manufacturing processes and details of the application of the major materials are covered in the first part, while the second part considers each material as an element in the design of buildings.

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Gasoline Tax Problems

THE ADMINISTRATION OF THE GASOLINE TAX IN THE UNITED STATES —By F. G. Crawford. Third edition. Paper; 7x10 in.; pp. 66; tables. Published by the Municipal Administration Service, 309 East 34th Street, New York, N. Y. 50c.

This third edition of Professor Crawford's familiar and informative study of the history, administration and repercussions of gasoline taxation in the United States is well warranted by the rapid changes in all phases of the problem in the two years since the last edition was published. The pamphlet has been enlarged by about 30 pages, and completely revised tables of rates, earnings, costs, distribution, etc., have been prepared. A comprehensive chapter of largely new material on administration and entirely new chapters on diversion and evasion have been added. The publication as it now stands should serve a useful purpose in the coming battle of highway interests to preserve the gasoline-tax moneys of the country for road improvement.

* * *

Philosophy of Contracting

ECONOMICS OF CONSTRUCTION MANAGEMENT—By J. L. Harrison, Division of Management, United States Bureau of Public Roads. Cloth; 6x8 in.; pp. 330. Published by Gillette Publishing Co., Chicago. $3.75.

The reader will find the chief value of this book to be in its presentation of the philosophy of construction management. It does not, for example, direct a contractor how to bid on a job, or tell him what equipment to select or give him a bookkeeping system. Instead it lays down the principles which control these and all the other multifarious determinations that have to be made by the construction manager. It is an agreeable experience to find a volume on this much-debated subject which realizes that so specific and individual a thing as a construction operation does not submit itself to prescribed codes. Each follows a code of its own creation, obeying only the fundamental principles controlling all sound codes. It is the expression and elucidation of these principles that the author strives to accomplish in this book. The chapter headings are as follows: The origin of profit, financing construction work, securing business, planning operations, purchasing the material supply, central office responsibility vs. responsibility of the job management, cost accounts and records, production cost and expenses other than for production, expense items other than for production, the control of expense other than for production, the management of production, where the plan of operation may fail, units, labor as a factor in cost, materials, operating expenses, depreciation, the equipment-replacement problem, functional adequacy and dependability, the value of improvements in equipment, hauling, financial statements.

* * *

New Fields of Interest

REFRIGERATING DATA BOOK AND THE REFRIGERATING CATALOG—First edition, 1932-33. Cloth; 6x9 in.; pp. 562; numerous illustrations. Published by the American Society of Refrigerating Engineers, 37 West 39th St., New York City. Single copies, $3.50; foreign $4.

REFRIGERATION—By James A. Moyer, professor in charge of the mechanical engineering department, Pennsylvania State College, and Raymond U. Fittz, assistant professor of mechanical engineering, Tufts College. Cloth; 6x9 in.; pp. 528; numerous halftones and diagrams. Published by McGraw-Hill Book Co., Inc., New York and London.

Growing interest in mechanical refrigeration and in air-conditioning, which has developed in the last few years, makes these two books of interest to an increasing number of civil engineers.

The section of the new book of the American Society of Refrigerating Engineers entitled "Data Book" includes chapters on the fundamental principles and data involved in refrigeration, one on refrigerating machinery for domestic, commercial and industrial installations, one on insulation and one on refrigeration equipment, pumps, fans, etc., and a chapter on installations. The latter is subdivided into air-conditioning, cold storage, frozen foods and ice plants. Other sections of the book include a list of members of the American Society of Refrigerating Engineers and a catalog of manufacturers of refrigerating equipment and machinery.

The section devoted to cold storage contains much information on insulating materials and methods of construction, which will be found of value to those engaged in the construction of warehouses for cold-storage purposes.

The second book, "Refrigeration," by Moyer and Fittz, while essentially a text book for the use of engineering students, has, nevertheless, been prepared with the reference-book requirements of the

practical man in mind. Two chapters are of special interest to civil engineers, one on insulation and cold-storage construction and the other on air conditioning. Other chapters describe systems and methods of refrigeration, mechanical equipment, properties of refrigerants, thermodynamics of refrigerating systems, ice-making, cold storage and quick freezing.

The Force-Polygon Method

Reviewed by Peter A. Strobel
Consulting Engineer, Yonkers, N. Y.

DAS KRAFTEPLAN-VERFAHREN — By J. D. Gedo. Paper; 7x9½ in.; pp. 184; 18 separate figures. Published by Alfred Kroner, Salomonstrasse 16, Leipzig, C-1, Germany. 12 RM.

THIS book introduces a new thought in the field of statics. It simplifies the general method for figuring highly statically indeterminate systems to the extent that the calculations involved are proportionate to the degree (n) of undeterminateness. The general method, as it is well known, very soon becomes hopeless. There are two reasons for this. (1) To write out the elastic equations one has to calculate $n\ (n + 1) \div 2$ coefficients, every one being an integral expression. (2) One has to solve n equations with n simultaneous unknowns.

Mr. Gedo eliminates altogether the calculation of the $n\ (n + 1) \div 2$ coefficients and by using a little known theorem, the reduction law, the equations are not simultaneous so that the unknowns can be figured step by step. The problems treated are: simple frames with hinged and fixed bases, box culverts, continuous beams, continuous frames with hinged and fixed bases, Vierendeel girders, skyscraper bents and multiple skyscraper bents. The book gives static and elastic criteria for every problem. The elastic criteria are similar o the theorem of three moments and this theorem appears in the book as a special case.

Though Mr. Gedo's method is just as correct as the general method the results nevertheless are obtained very quickly. The appearance of the book is timely, because nowadays the trend is decidedly against the use of the classical theory. This book may change this (hitherto justified) trend and that is why its translation into the English language is highly desirable.

Miscellaneous Notes on Booklets and Reprints

RAILWAY STATISTICS of the United States for the year 1931 are given in the 29th annual publication of a condensation of the Interstate Commerce Commission's statistics prepared by the Bureau of Railway News and Statistics, Daily News Building, Chicago, Ill. Comparisons are made with 1930 figures, and many of the statistical tables are carried as far back as the opening of the century, some farther. Recent statistics on foreign railways are included.

REVISIONS OF THE MANUAL of the American Railway Engineering Association, as adopted at the 1932 convention, are published separately in an 85-page pamphlet as Bulletin 347 of the association. Copies may be obtained from the association, 59 Van Buren St., Chicago, Ill.

GROUNDWATER SUPPLIES estimated from the discharge by plants and evaporation from the soil is the subject of Geological Survey Water-Supply Paper No. 659-A. The method described is based upon a study made by Walter N. White in the Escalante Valley, Utah. Copies of the paper may be obtained from the Superintendent of Documents, Washington, D. C. Price 20c.

HOUSING IN PHILADELPHIA, 1931, is the subject of a pamphlet prepared by Bernard J. Newman. The matters covered are the problem of shifting population, home ownership and rents, dwelling construction, demolition, sheriff sales and sanitation. The pamphlet is published by the Philadelphia Housing Association, 1600 Walnut St., Philadelphia, Pa. Price 25c.

THE PORT OF BILBAO, Spain, on the Bay of Biscay, and the work being done to modernize it is described in the 1931 annual report of the department of works of Bilbao. One of the most important projects is the lengthening of a pier by means of 50-cu.m. precast blocks placed with a large traveling crane. Published by the Junta de Obras del Puerto de Bilbao, at Calle del Correo, 9, Bilbao.

MOTOR-VEHICLE ACCIDENTS in the state of Connecticut are the subject of the eighth study of such accidents to be published by the Hartley Corporation, New Haven, Conn. The study was made by Prof. Richard Shelton Kirby of the department of civil engineering, Yale Univsersity, in cooperation with the state department of motor vehicles. The study was begun in 1924 and has been continued through the Hartley Corporation's annual gift for traffic research.

WATER RATES AND REVENUES and the results of municipal ownership in the United States compose the subject of a statistical study prepared by R. E. McDonnell and published by Burns & McDonnell Engineering Co., Kansas City. The study is based on an analysis of the operation of 225 municipal and 25 privately owned water plants. The statistics given include: ownership figures by states for 10,708 water plants, the character of ownership of filtration plants in 49 cities of 100,000 population or more, partial list of cities operating water-softening plants, relative values of waterworks by years since 1913, profits of 100 municipal water plants, a partial list of cities operating both water and electric utilities, and the cost of water delivered to consumers in the 250 cities studied. The foreword states frankly that the factual information is presented to demonstrate that municipal operation has proved to be a profound success. Copies of the pamphlet may be obtained from the company. Price $1.

New Books and Revised Editions

[Those desiring copies of the books listed below or mentioned elsewhere in this section should order them from the publishers or from their local booksellers.]

A NEW DEAL—By Stuart Chase. Cloth; 6x8 in.; pp. 257. Published by the Macmillan Co., New York City. $2.

VERMESSUNGS-KUNDE—By M. Nabauer. Second edition. Cloth; 7x10 in.; pp. 401; diagrams and tables. Published by Julius Springer, Berlin, Germany. Price 23.50 RM.

DER INDUSTRIEBAU — By Hermann Maier-Leibnitz. Cloth; 8x11 in.; pp. 308; many line drawings and photographic illustrations. Published by Julius Springer, Berlin, Germany. 55.50 RM.

UBER DEN SICHERHEITSGRAD VON HOCHBEANSPRUCHTEN EISENBETONKONSTRUKTIONEN—By H. Olsen. Paper; 7x10 in.; pp. 144. Published by Wilhelm Ernst & Sohn, Berlin, 15 marks.

THE PORT OF HAMBURG—By L. Wendemuth and W. Bottcher. Second edition. Cloth; 7x9 in.; pp. 278; many illustrations. Published by Meissner & Christiansen, Hamburg, Germany.

ST. LAWRENCE WATERWAY PROJECT—Report of Joint Board of Engineers (Reconvened) on the International Section. Cloth; 9x13 in.; pp. 21; many folding maps. Department of Public Printing, Ottawa, Ontario, Canada. $2.

PLANS FOR MAJOR TRAFFIC THOROUGHFARES AND TRANSIT—Prepared for the Lower East Side Planning Association (New York City) by Bartholomew and Associates, City Plan and Landscape Engineers, St. Louis, Mo. Board; 9x11 in.; pp. 188; photographs and maps.

POPULATION CHARACTERISTICS BY CENSUS TRACTS, CLEVELAND, OHIO, 1930—By Howard Whipple Green. Cloth; 9x12 in.; pp. 236; numerous tables, maps and line drawings. Published by The Plain Dealer Publishing Co., Cleveland, Ohio. $25.

SEWERAGE AND SEWAGE TREATMENT—By Harold E. Babbitt, professor of sanitary engineering, University of Illinois. Fourth edition. Cloth; 6x9 in.; pp. 596; numerous illustrations. Published by John Wiley & Sons, Inc., New York and London. $5.

THE PORT OF TOLEDO, OHIO—Lake Series No. 7. Prepared by the Board of Engineers for Rivers and Harbors, War Department, in cooperation with the Bureau of Operations, United States Shipping Board. Paper; 6x9 in.; pp. 100; maps, tables and photograpic illustrations. Published by the Superintendent of Documents, Washington, D. C. 45c.

THE PORT OF WILMINGTON, DEL., and PORTS ON THE DELAWARE RIVER BELOW PHILADELPHIA. Port Series No. 4, Part 2; revised 1931. —Prepared by The Board of Engineers for Rivers and Harbors, War Department in cooperation with the Bureau of Operations, United States Shipping Board. Paper; 6x9 in.; pp. 119; maps, tables and photographic illustrations. Published by the Superintendent of Documents, Washington, D. C. 25c.

Engineering News-Record

EDITOR—F. E. Schmitt. EDITORIAL STAFF—V. T. Boughton, W. G. Bowman, F. W. Herring, C. S. Hill, H. W. Richardson, W. W. De Berard, N. A. Bowers, J. I. Ballard.

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Minimum Wage Rates

FOR the first time in the history of this country minimum wage rates have been set up in every state in the Union, as diagrammed in the news pages of this issue. They are the result of a requirement written into the Emergency Relief and Construction Act of 1932 that state highway departments fix minimum labor rates on road work done under Title III of that act. Already these rates are being applied to other relief operations, and in some cases to normal highway work. Since efforts may be made to perpetuate the principle, their future as well as present bearing on construction operations makes the establishment of these rates an event of long-time significance.

The First Stage Ends

THE FIRST stage of work at Hoover Dam ended when the Colorado River was turned into the diversion tunnels on the Arizona side of the canyon on November 14. Up to now the major problem before the men charged with damming the Colorado was that of diverting the river from its normal channel in order that the foundations of the dam could be carried down to a firm foundation far below water level. The great diversion tunnels have now been dug, and during the past weeks work has been pushed rapidly on the cofferdams while lining the tunnels was under way. On Sunday two tunnels were ready, the barrier protecting their portals was shot away, and by the following day the river gap had been filled, turning in the water. The other tunnels will soon be completed, and water can be turned into them also. This stage of the work had to be reached during a time of low water if much time was not to be lost. The engineers and contractors are to be congratulated on having succeeded in obtaining their first great objective.

Self-Supporting Waterways

SIGNIFICANT action having a bearing upon the future of artificial inland waterways, as discussed in these pages last week, was taken recently in Kansas City when the Chamber of Commerce disbanded its waterways committee and came out strongly against further government subsidies to any form of transportation. The chamber wants every form of transport to stand on its own feet. Coming just a few days before the start of Senate Committee hearings on the St. Lawrence Waterway treaty, this action serves to indicate a changed temper toward waterways that is bound to be in evidence at those hearings. So far the testimony has brought out facts which the proponents of the waterway will have difficulty in controverting. Those who, like the Kansas City Chamber of Commerce, look to such undertakings to be self-supporting put forward a question that will not be downed until it is fully answered.

Credit Where Due

QUOTING a publicity release of American Engineering Council, recent newspaper reports state that the council has been engaged in organizing the engineering profession to cooperate with the Reconstruction Finance Corporation in mobilizing projects for construction loans. This assertion is passing strange, in view of the facts of the case. It is true that much work has been done throughout the country to bring out self-liquidating projects for early prosecution under R.F.C. loans, in order to carry out the vital purpose of the Relief Act; but this work was done by the National Trade Recovery Committee, not by the American Engineering Council. Working quietly but effectively, the committee has done a great deal toward organizing the profession and the business community in support of its efforts in this direction. The council has not. Quite the contrary; the council long remained unfriendly to the legislative steps that led up to the Relief Act, and in fact unfriendly to all measures that aimed at bringing about business recovery by construction employment. It allowed its name to be used in denunciatory attacks on activities looking toward construction revival. Its opposition may have contributed measurably to creating the deadly stalemate which from early Spring until now has kept men from R.F.C. construction work. If the council is now tardily duplicating the labors of the trade recovery committee, in fairness it should refrain from attempting to take credit which belong to that committee.

A Long Road

AT 11:45 p.m. on Nov. 19 the village of Wilmette, Ill., awarded a contract for waterworks, the first actual R.F.C. construction to become a reality. Since July 20, when they submitted the loan application to the R.F.C., the village officials have made a continuous drive to put men to work on the project. Four months were required to bring success. Perhaps a month of this time might be charged to delays within the R.F.C. organization, now eliminated, and an equal time to inexperience of the Wilmette authorities and to pertinacious minority opposition, which even yet threatens an injunction. The remaining two months' time, however, is about the practical minimum that a municipality can count on in obtaining R.F.C. funds. Officials planning to make application might well lay down a schedule, in which the legal formalities in the way of ordinances and authorizations are fitted in to council meeting dates, the required intervals for public notices, advertisements and the opposition's "day in court" are allowed for, and ample time provided for the R.F.C.'s investigation of the project. Getting money for meritorious construction is even harder than obtaining funds for doles, but it is worth the effort.

Light Floors for Bridges

CONTINUOUS effort to eliminate unnecessary weight and bulk in floors has been made in both the bridge and the building field. As a result, there has been steady progress in both fields; and though recent

developments such as plate, channel and cellular floor types are directed mainly at the building problem, there has also been much constructive thinking about bridge floor improvement. A distinct step of advance was made in the floor of the Hudson River Bridge at New York. A further step of radical kind is now being attempted at Seattle, where a floor of grating is being applied to a bridge as both carrying structure and surface of the deck. The attempt bears much promise, and the test of practical use of the novel traffic-carrying construction will be followed with interest, as its success will promote both simplicity and economy of construction. Floors and floor surfaces alike have been continuing problems on many modern bridges where consideration must be given to grades, smoothness of surface, adaptability to all weather conditions, light weight and resistance to load and wear.

Thirty Years

QUIETLY, without special celebration, an anniversary was recorded last week that deserves a moment's thought by all men of industry, by men of the construction field particularly, and also by the public at large. It was the thirtieth birthday of the Portland Cement Association. Though the organization began life under an alias, Association of American Portland Cement Manufacturers, and did not assume its present name until more than a dozen years later, its growth and work have been continuous. During three decades it has been in the vanguard of that broad movement which built up the first stage, imperfect though it be, of industrial cooperation. For most of this time the Association also has cultivated the advancement of knowledge by research and by educational effort, and here particularly it has achieved such success as to set a shining mark for all industrial groups in their cooperative activities.

The evolution of industry associations is quite recent. Substantially they are a product of the present century, prior to which time individual isolation or else surreptitious understandings were the rule. The modern industry association moves along a different course, toward purposes that serve the public's interest as well as its own. It has still far to go in developing its function, for human as well as legal barriers stand as obstacles—witness the paralysis of the broadly conceived Swope proposal. But in the progress of the movement up to now the Portland Cement Association has been a leader, a maker of precedent in many ways. For this reason the anniversary has meaning alike for the captain of industry and the citizen in general.

Research to develop new knowledge and the dissemination of useful information about the service of its products has occupied the organization for fully a quarter century. When it began in this work there was little understanding of the concept that an associated industry has a function in furthering the sciences and the arts on which its business is erected. Since those early days, however, this concept has grown to large stature. In so far as such growth was stimulated by the activities of the Portland Cement Association the organization merits the study as well as the appreciation of all who are actively concerned with industry's problems.

A long path lies ahead for industry cooperation. Never has this been made clearer than now, through the influence of the intense economic stress of the past three years. Out of the welter of inconclusive discussion over the question of how we may in future be able to stabilize our community's economic life, one fact at least has emerged: that the industrial unit groups and not single industrial enterprises will be essential factors in the hoped-for stabilization. The single business enterprise will largely be powerless, but the unified group, it now seems, can achieve more or less control—more, rather than less, we trust. That the Portland Cement Association has not been particularly successful in this direction is obvious. It has as much progress to make in future as has any industry. Yet both its spirit and its methods as expressed in its past work are noteworthy models for all industrial groups in their efforts to achieve effective cooperation.

Finally, the example of the Association brings encouragement to all of the diverse elements of the construction field. They have been able to do little toward unification, and therefore many grave internal problems of the field are not likely to approach adjustment for a long time to come. But the fact that one of the important units of the construction field has succeeded during so many years in maintaining cooperation—even though incomplete—offers firm assurance that cooperative unification of the construction industries is not an unattainable ideal. These industries, then, have most reason to take note of last week's thirty-year anniversary and to study the purposes and aims which animated the three decades of activity.

A New Research Call

NEW HOPE of a successful defense of highway building comes from the conference a week ago in Washington of federal and state highway officials. In a program characterized by a complete departure from questions of roadbuilding technique, the Secretary of Agriculture (as department head of federal highway activities) sounded a positive call for research which would make possible balance sheets and budgeting of the highway business.

This demand goes directly to the heart of the most important duty of public-roads officials. If they fail in its performance, they cannot and should not expect continuation of the favor and funds which have for a decade made road improvement a leading public-works activity. The forces that are concentrating against highway development, to capture the great treasure that the road-user contributes yearly for road service, can no longer be repulsed by old arguments. Roadbuilding must show definite proof of its solvency and business success. By and large it now lacks this evidence.

The highway officials of America have done a praiseworthy work in creating a highway business with an assured income from the users of the roads. They have provided themselves through research with efficient equipment for all requirements of this task. The necessity is before them of protecting this business and its income from depreciation, and for this task they have to provide other and equally adequate equipment. They have to learn investment and upkeep costs, operating expenses, earnings and income as fully as they now know the details of road structures. The new knowledge is available by the same method—directed research. The advice of the director of federal road activities as quoted elsewhere in this issue should be written in bold letters in the program of every highway department in the United States.

NEWS OF THE WEEK

Housing Problems Heard at Meeting of City Planners

ECONOMY and security through planning was stressed at the 24th National Conference on City Planning, held in Pittsburgh, Nov. 14-16, 1932. The program resulted in lively discussions of housing and slum clearance, financial programs, municipal taxation and the expansion of public works construction. Throughout the meeting, emphasis was placed on the fundamental economic basis for replanning cities, and on practical ways to make such plans effective, once they are adopted.

Housing as a public utility

Robert D. Kohn, New York, N. Y., held that low-cost housing has a public utility import and that this is recognized in the housing clause of the 1932 Relief Act. He stated his belief that what was undertaken as an emergency policy will have to be continued. Mr. Kohn emphasized the need of experimentation to evolve designs suitable for American localities, learning from but not blindly following European practice. Decentralization he opposed. Instead, he believes the layout of new residential sections at the perimeter will have to be slowed down, and the blighted centers of cities replanned and rebuilt. Large scale rehousing was held to offer the most promising opportunity to counteract technological unemployment.

In a paper entitled "What the Planner Can Contribute," Henry Wright, collaborator in the design of Radburn, N. J., and Chatham Village, Pittsburgh, stated that opportunities for accomplishing results by control of land subdivision and by zoning are now limited, due to slowing-up of the hitherto rapid territorial expansion of cities.

Private financing advocated

The subject of "Housing Finance" was presented by Orrin C. Lester, vice-president, Bowery Savings Bank, New York, N. Y. He advocated resort to public funds only when private sources become exhausted and then only for such emergency purpose as housing of the extremely poor or the replacement of slum areas. However, he could see little prospect for much low cost housing in the United States under present methods of land speculation.

John Ihlder, Pittsburgh, Pa., looked at low cost housing from the community point of view, advocating that instead of accepting present land values and adjusting a program to them, authorities should determine the most suitable use of urban land and adopt policies which will bring land costs down to the level socially desirable.

The economic danger in decentralization was emphasized in an address by Harland Bartholomew, president of the conference. He pointed to the decay of central areas and expressed concern as to how long

(Continued on p. 635)

Wilmette Lets First Contracts to be Paid with R.F.C. Funds

Four months after the preliminary application was made for R.F.C. funds with which to build the 6-m.g.d. waterworks for Wilmette, Ill., contracts were awarded Nov. 19 on bids received Nov. 15. The plant is a new one to replace a supply now purchased from the adjoining city of Evanston. It consists of intake, motor-driven pumping station and filtration plant on which bids had previously been opened Apr. 5 but had to be rejected because the bonds could not be sold through the regular channels. Bids on the two dates are not exactly comparable but essentially so and reflect a reduction of more than 10 per cent in cost of the work. Award was not made on an engine generator standby unit for which the low bid was $4,900.

The following are the awards: For waterworks structures, Owen Engineering Co., Chicago, $189,746.20; for piping and filter equipment, E. W. Bachrack, Kansas City, Mo., $105,925; pumping equipment, Allis-Chalmers Manufacturing Co., Milwaukee, Wis., $15,326; for electrical work, Wadeford Electric Co., Chicago, $10,544; for 3,000 ft. intake, 33 in. steel pipe, ¾ in. thick, Merritt-Chapman and Whitney, Chicago, $58,354; for 1,850-ft. connecting main, 16-in. cast iron, Nicholas Santucci, Niles Center, Ill., $8,449. This last item was not in the Apr. 5 bidding.

Architects to Honor Engineers

In order to give expression to the close bond between civil engineering and architecture, the Architectural League of New York will give a dinner on Dec. 15 at which three prominent bridge engineers will be guests of honor as representatives of the engineering profession: Gustav Lindenthal, Ralph Modjeski and O. H. Ammann. The principal address is to be made by Cass Gilbert, architect, speaking for the hosts. Francis Lee Stuart, past president of the American Society of Civil Engineers, is to acknowledge the presentation on the part of the civil engineering profession.

Truck Regulation Recommended to Utility Commissioners

URGENT need for federal regulation of motor truck operation was brought before the National Association of Railroad and Utilities Commissioners by its committee on motor vehicle transportation at its annual meeting held at Hot Springs, Ark., Nov. 15-18. The committee believes that the minimum amount of federal regulation consistent with state control is desirable but that if disorganization of the transportation system of the country through the development of wildcat trucking concerns is not checked by adequate regulation the people will "tax the motor carriers off the highways." The committee said further that "unbridled and unrestricted operations of interstate carriers and failure of state authorities, principally legislators, to exercise jurisdiction and make and enforce reasonable rules and regulations have brought upon the industry evils which promise to engulf it. Perhaps there is no one so much to blame for this condition as the truck operators and the automobile manufacturers whose efforts to thwart regulation apparently have paralyzed the hands of Congress and smothered the commendable attempt of this association to remedy the situation."

Regulation of contract carriers as well as common carriers by trucks also was recommended by the committee and the efforts of Texas, Kansas, and Oklahoma in this direction were commended. The committee's report says that the contract carrier does everything that the common carrier does except pay his proportion of the taxes. A limit of 500 miles for motor truck operation was recommended. Traffic beyond that limit rightfully belongs to and should be handled by the railroads according to the committee.

Ernest I. Lewis, a member of the Interstate Commerce Commission, expressed himself as opposed to proposals frequently made for discontinuing the federal valuation of the railroads. The information so compiled is of importance in so many ways in railroad regulation, in rate questions, and questions of security issues as to make it desirable that the work be kept up to date.

Establishment of a federal fact-finding agency to determine the relation of holding companies to public utilities was recommended to the association by Hugh White, president of the Alabama Public Service Commission, and Mayland H. Morse, of the New Hampshire Commission, recommended state control of the relations between holding companies and public utilities. Both recommendations were approved.

Federal participation in the financing of future railroad operations was recommended to the association by John F. Shaughnessy, of the Nevada Public Utility Commission. He believes that the federal government should participate to the extent of 25 per cent of future investment requirements in order to insure private management and operation at lower rates for money than is now possible and at the same time to facilitate federal regulation.

Repeal of the railroad consolidation provisions in the transportation act of 1920 was recommended to the association in the report of its Committee on Consolidation of Railroads.

The next annual meeting will be held in Cincinnati in October, 1933.

Timber and Lumber Progress Reviewed at A.S.T.M. Meeting

TIMBER as an engineering material comprised the subject for the first meeting of the year, on Nov. 17, of the New York district members of the American Society for Testing Materials. The program, arranged by Hermann von Schrenk, consulting engineer, St. Louis, and chairman of the society's committee on timber, was planned to present the viewpoints of both user and manufacturer. J. V. Neubert, chief engineer, maintenance of way, New York Central Lines, and president, American Railway Engineering Association, and E. J. Russell, St. Louis, president, American Institute of Architects, represented the user side of the question. J. F. Carter, chief engineer, Southern Pine Association, outlined the progressive steps that have been taken by the lumber associations to place lumber in the class of engineering materials. Mr. von Schrenk reviewed the progress made in protecting timber against deterioration. A motion picture film prepared by the British Wood Preservers Association portrayed some remarkable microphotography of fungus growth and insect action in destroying timber.

Long-life creosoted timber

Railroads are probably the largest users of timber, as a result of their huge cross tie requirements, said Mr. Neubert who reviewed the growth of the use of preservative treatment from its very meager beginnings about 25 years ago. At that time it was estimated that creosote treatment would increase the life of a cross tie to 16 years from an 8- to 10-year life, which was common for untreated ties. Experience on the New York Central Lines has shown that the life of a treated tie is nearer 25 years than the estimated 16. According to Mr. Neubert no composite or substitute tie yet developed can offer the economy and long life that has been proved for treated timber ties.

Greater uniformity needed

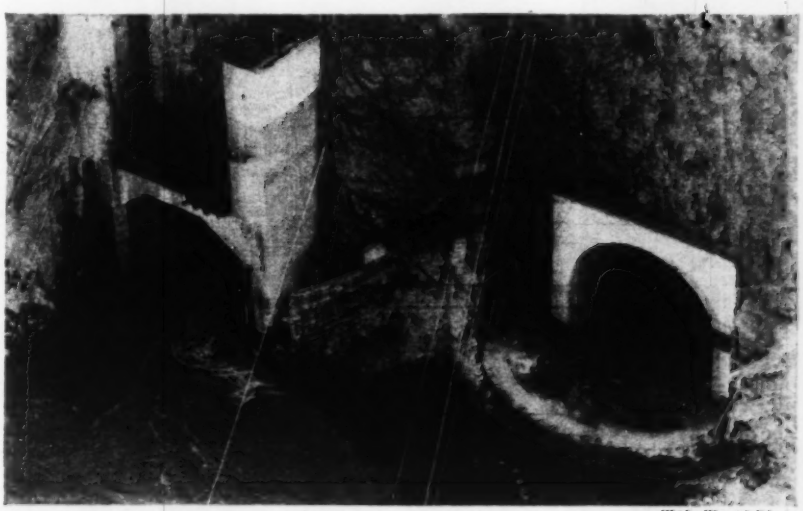
Lack of uniformity and the poor quality of much lumber were given by Mr. Russell as the principal reasons why it was not used in greater volume by the building industry. While these reasons do not apply as widely today as formerly, thanks to the activities of the lumber manufacturers, the architect, in general, is not yet aware of this fact. Grade-marking and improved manufacture have done much to place timber in the class of engineering materials, but in Mr. Russell's opinion the lumber industry must treat all of its product so as to protect it from deterioration and fire before the building industry will accept it without reservation.

That the lumberman is making it easier for engineers to specify timber with certainty as to its quality and uniformity was emphasized by Mr. Carter who also urged engineers to give the same serious consideration to the qualities and characteristics of timber and lumber that they do to other construction materials. Engineers should not attempt to write their own specifications for lumber, as many of them do, but should place absolute reliance on the specifications drawn up by the lumber associations. Briefly, lumber manufacturers suggest the use of their grade-use recommendations and in addition that engineers insist that every piece of lumber shall bear the official grade mark of the lumber manufacturer. By these means all worries about the haziness of grade rules will be eliminated. Present-day timber, said Mr. Carter, is selected, manufactured and graded in accordance with principles laid down by the engineering fraternity an if those engineering principles are sound, it is logical that designers and specifiers should use the lumber association's values in design. The heavy factors of safety which have been so frequently employed not only hurt the lumber industry but add to the cost of the structure and should be discarded.

Lumber industry facilitates design

Some of the progressive activities of the lumber industry are as follows: designing connectors for post, beam, truss and arch members; producing glued-up members from smaller pieces; treating at lower cost to resist decay, insect and flame; fabricating at the mills to exact size and shape for construction in both large and small structures; drying to more uniform moisture content; improving paintability; designing ready-made panels. One other activity that has been proposed, and will be adopted by the Southern Pine Association, at least, is the establishment of a department to inspect and grade mark treated material.

In discussing preservative treatment for timber, Mr. von Schrenk stated that impregnation is the only efficient method. Painting of preservatives is a waste of money. The impregnating chemicals must not only be initially poisonous to fungi, termites, etc., but must remain poisonous over a period of years. Preserved timber, in the opinion of Mr. von Schrenk, can be made to last just as long as the economic life of the structure into which it is placed. On the Big Four Railroad the life of creosoted timber is 26.6 years while ties placed in 1910, 22 years ago, are still in good condition. Creosoted bridge timbers have an even longer life because they usually are not subjected to mechanical destruction as are cross ties. Creosoted piles have an indefinitely long life, and are being widely adopted as evidence by the fact that 17 million were installed in 1930 as against 4 million in 1909. Mr. von Schrenk pointed out the danger of using untreated wood for river and harbor structures and counting upon the pollution of water by sewage to keep marine organisms out. The increasing demand for sewage treatment may result in the cleaning up of these waters with the result that marine organisms will destroy the untreated timber structures. Creosoted timber bridge decks should be so designed that long horizontal flues are not formed by the stringers. If anything, American practice does not use enough creosote per piece of timber. European practice could teach us something in this regard, said Mr. von Schrenk.



Wide World Photo

DIVERSION STARTS AT HOOVER DAM

Turning of the Colorado River into the diversion tunnels at Hoover dam was begun on Nov. 13 when the concrete cofferdam and the rock barrier between the river and upper portals of tunnels Nos. 3 and 4, both on the Arizona side, were blown away. The accompanying photograph shows the first small stream of water entering tunnel No. 4 as rock dumped from a trestle below the portals, supplemented by rock shot into the river when the barrier was blown out, began to raise the water level. Below the portals of the tunnels the river channel had been narrowed by work described elsewhere in this issue. The trashrack foundation in front of tunnel No. 3 (at right in illustration) had been built to El. 652, or 12 ft. above tunnel invert. Water did not start to flow through this tunnel until the dike had stopped all flow in the river, accomplished early on the morning of Nov. 14. Latest reports state that this dike has now been filled to El. 660, and work is in progress to raise it to El. 690, the top of the tunnels. Three shovels and a dragline are excavating behind the dike for the permanent cofferdam. Along with the construction of the upstream dike, a similar structure was built across the river just above the outlet of tunnels Nos. 2 and 3, closing off the dam site. Unwatering of this site is now in progress. Blowing out of the concrete cofferdam and rock barrier was spectacular, 3,500 holes being loaded with 15 tons of dynamite. Tunnels Nos. 3 and 4 are complete except for high-pressure grouting, which will be done after they are unwatered again. Tunnels Nos. 1 and 2, on the Nevada side, will be ready for diversion about Jan. 1.

Minimum Wage Scale on Relief Work Set by State Highway Departments

MINIMUM wage rates for highway work where federal relief funds are used have been set by all the state highway departments of the country. This action has been taken in conformity with Title III of the Emergency Relief and Construction Act of 1932. The act, in providing $120,000,000 for use on the federal-aid highway systems, requires "that all contracts involving the expenditure of such amounts shall contain provisions establishing minimum rates of wages, to be predetermined by the state highway department, which contractors shall pay to skilled and unskilled labor, and such minimum rates shall be stated in the invitation for bids and shall be included in proposals or bids for the work." The act further provided that no individual directly employed on such projects shall be permitted to work more than 30 hours in any one week.

The accompanying diagram shows the minimum wage rate for skilled and unskilled labor (skilled and common) set by each state. In some states where employment conditions vary widely no statewide rates have been set, in others special rates have been set for counties or certain districts, and in still others existing prevailing-wage laws do not make it possible to give a single figure. Further, figures for skilled labor are not truly comparable in many instances as there is no sharp line of demarcation between the skilled and unskilled classifications.

Special qualifications have been set up in a number of states as follows: Arizona gives rates for each major class of skilled labor and requires that work shall be done in two five-hour shifts a day.

In California the wage rate for skilled crafts varies throughout the state and under the prevailing-wage law of the state it is the duty of the highway department to ascertain the prevailing wages in the locality in which work is to be done and to specify it in the call for bids.

Delaware set the higher rates of 40 and 30 cents in Newcastle county. Wilmington is located in Newcastle county.

Indiana has a new wage law which requires that contractors shall stipulate in their bids the hourly wage they propose to pay laborers and that it shall not be less than the hourly wage paid by the highway commission for common labor.

In Kansas the actual minimum rate under certain conditions may be 55 cents and 40 cents.

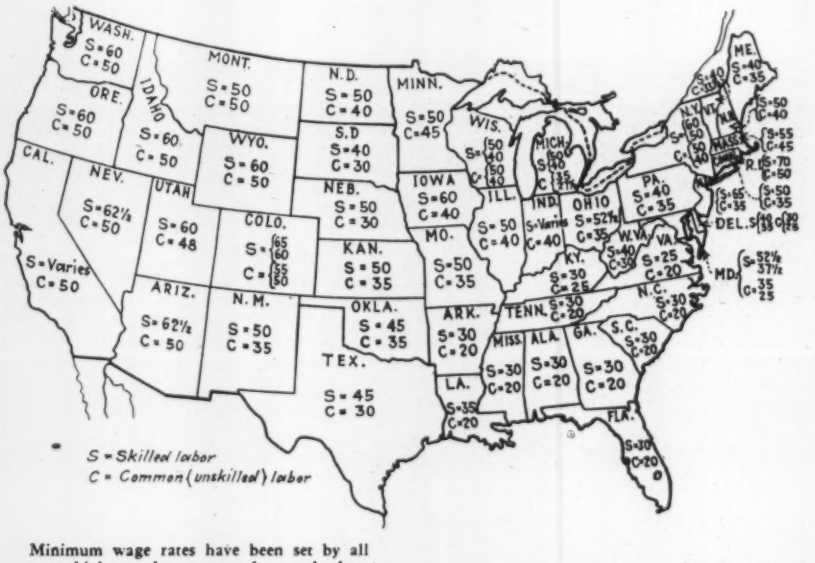
Maryland has a low rate in the nine counties of the eastern-shore and the lower portion of the western-shore sections of the state.

Michigan requires a higher rate to be paid near industrial centers than is paid in the strictly rural communities.

Montana sets minimum wage rates for each class of skilled labor much as is done in Arizona.

New York prescribes a higher rate for New York City, Long Island, Westchester and Rockland counties.

Pennsylvania minimum rates are not uniform throughout the state.



Minimum wage rates have been set by all state highway departments for work done with funds provided by the Emergency Relief and Construction Act of 1932. The rates set in each state are here shown classified as skilled and common labor.

Texas prescribes a ten-hour working day and permits men to be employed for three ten-hour days or for six five-hour days.

Virginia sets a minimum rate for all the major classifications of skilled labor, the lowest being 25 cents an hour. The state of Washington does likewise with a minimum set at 60 cents an hour.

Wisconsin has established higher rates for certain counties and a lower minimum for the remainder of the state.

The rates shown for Wyoming apply except on camp projects where the minimum rate for skilled and unskilled labor is 45 cents an hour with a charge not exceeding $1 per day for board.

Board rates have been prescribed in several of the states and range from 50 cents to $1 a day.

Inability of Railroads to Act Stops Grade Separation Work

The inability of the railroads in the State of Massachusetts to provide funds for new construction has practically brought to a standstill the program of grade crossing elimination ordered by the state legislature in 1930. The act of 1930 provided that the cost should be divided between the railroads, the state and the municipalities affected. A list of 44 crossings to be abolished has been submitted to the Department of Public Utilities by the Department of Public Works as required by the act but so far only two crossings have been eliminated. Consequently, the department will make no more recommendations.

Private Water Company Bought by City of Dixon, Ill.

At an agreed price of $520,000, the city of Dixon, Ill., has taken the initial steps to purchase the property of the Dixon Water Company. C. W. McNear and Co., a bonding house of Chicago, is financing the plan. Burns & McDonnell, consulting engineers, Kansas City, a year ago appraised the plant for the city at $440,000, while Gordon and Bulot, consulting engineers, Chicago, made a valuation of $540,000 for the company. The engineers for the city recommended $50,000 for extension of the distribution system.

Municipal Light Plants in Florida Subject to Tax

The Florida supreme court has ruled that lighting plants operated by municipalities are not exempt from provisions of an act passed by the 1931 legislature which places a tax upon "all corporations, firms and individuals receiving payment for electricity for light." The tax was attacked by certain municipal corporations on the ground that it violated the organic law of the state relating to such corporations.

The court in its decision said, "The tax here considered is a license or excise tax on the corporations for the exercise by them of the granted statutory privilege of doing the business of selling electricity, etc., the amount of the excise tax to be determined or measured by reference to a given percentage of the gross receipts derived from business done in this state by all corporations including municipalities, and the tax is upon the corporation for engaging in the corporate business, not for the exercise of governmental functions.

"The governmental functions and the corporate business activities of the municipal corporation are quite different. In general, when a municipality exercises a corporate authority to engage in a permissible business or occupation as distinguished from the performance of an authorized governmental function, the regulations that are by law applicable to such business activity may be made applicable to municipal corporations.

"As it appears that the several complainants are operating and maintaining a public utility as more or less of a business venture, they are, in such capacity, governed by and subject to the same laws as a private corporation engaged in a similar undertaking."

St. Lawrence Railway Bridge to Be Decked for Highway

Work will commence December 1st on the project of planking the bridge spans of the Ottawa and New York Central Railway, division of the New York Central Railway, over channels of the St. Lawrence River between Cornwall, Ontario, and Massena, New York. The expenditure will be approximately $160,000 and the scheme includes construction of approaches as well as of a connecting road across Cornwall Island. The work is being undertaken by the Cornwall-Massena International Bridge Company.

Ohio Limit on Use of Highways Before U. S. Supreme Court

The right of the State of Ohio through its public utilities commission to bar an interstate trucking corporation from the use of certain highways of the state on the grounds that the highway already is badly congested is to be passed upon by the United States Supreme Court. Some months ago the public utilities commission of the state refused a permit to a trucking company to operate in interstate traffic over Route 20 from Cleveland to the Ohio-Michigan state line on the ground that the highway was too congested, but granted a permit to the company to operate over a less-congested route. This ruling was upheld by the Ohio supreme court. The trucking company maintains that this ruling is arbitrary and unreasonable and discriminates against it in favor of other common carriers holding certificates to operate over the route in question and is unlawful regulation of interstate commerce.

New York Awards Contract for Two Incinerators

Contract for the construction of two refuse incinerators in New York City were awarded to the Superior Incinerator Co. of Texas and the L. E. Meyers Co. on Nov. 18. Bids were received from 16 bidders. The lowest bid, submitted by the Brader Construction Co., was rejected because it failed to provide a traveling crane as required by the specifications.

One of the incinerators is to be built in Manhattan, at 215th St. and 9th Ave., and the other in the Bronx, at Zerega and Hermany Aves. Their construction forms part of a program of providing garbage disposal facilities in accordance with an order by the U. S. Supreme Court to discontinue dumping garbage at sea before June 1, 1933.

Each plant is to have an installed capacity of 750 tons daily, comprising 5 furnaces of 150 tons capacity each. The specifications prepared by the department of sanitation stated the basic design elements of the incinerators, such as grate area and all other major elements governing the size of the equipment. The cost of each plant had been estimated at $1,000,000. The bids on which the contract was awarded were $707,000 for the plant in Manhattan and $724,000 for the one in the Bronx. The contract calls for completion within 200 working days.

Conservancy District Bond Sale to R.F.C. Gets Court Approval

The supreme court of New Mexico, on Nov. 4, approved the sale of $5,784,000 of bonds of the Middle Rio Grande Conservancy District to the Reconstruction Finance Corp. in a suit brought by a taxpayer to enjoin the sale of the bonds. In order to permit the district to go ahead with its construction work, the R.F.C. agreed to purchase its unsold 5½ per cent bonds amounting to $5,784,000 at 90. The legality of this proposed sale was questioned in the taxpayer's suit.

Actual sale of the bonds to the R.F.C. cannot be made until the district is able to subordinate its outstanding bonds to the ones to be sold to the R.F.C.

Housing Problems Before City Planners

(Continued from p. 632)

American cities can withstand such an economic shock. "Such disintegration is doubly wasteful, for it not only creates huge burdens of additional debt and more annual overhead expense to furnish public services in new outlying districts, but in the older central districts values are destroyed and revenues reduced while municipal services must be continued. This is a vicious circle of inestimable danger," he said. There are six main causes of city disintegration: first, the observance of unsound social standards in building development; second, unwarranted spread of the city area, induced by new forms of transportation; third, the idea that population growth is unlimited and cannot be provided for in advance planning; fourth, unbalanced design of the city resulting from improper arrangement and distribution of land uses; fifth, excessive speculation in real estate; sixth, erroneous ideas of individuals that they can escape the consequences of unorganized city growth.

Cities must follow a six-point program if they are to escape the fate they are now heading toward, he said. He suggested, first, a careful estimate of total population to be provided for in the next 30 to 50 years; second, a determination of the total area required for urban purposes by each city; third, a plan for the most appropriate location and distribution of commercial, industrial and residential areas; fourth, a plan for the most desirable distribution and density of population; fifth, official adoption by cities of comprehensive plans for future development; and sixth, reconstruction of decaying central areas.

Municipal financing and taxation

Advanced planning of public works construction was urged by D. H. Sawyer, director of the Federal Employment Stabilization Board. He recommended that commissions with functions similar to those of the federal board be set up in the several states and that planners cooperate in the preparation of municipal financial programs for capital expenditures. In discussing the subject, Harland Bartholomew pointed to the need of any financial program being based upon a comprehensive physical plan of the community.

"Fairer Financing" was the subject of an address by J. Lionberger Davis, chairman of the board, Security National Bank Savings & Trust Co., St. Louis, Mo. He saw no conflict between "social engineering" and sound economics. He stressed the point that in real estate financing the basis of lending is not only what is but what is to be, confirming the idea previously brought out in the conference that in real estate lending there should be less emphasis on appraisals of individual properties and more on stabilization of neighborhood and community values.

A comparison of municipal tax policies and their effect upon civic improvements was drawn by Harold S. Buttenheim, New York. The theory of high land taxes, as opposed to the sales tax idea, was supported as a means of making it possible for the community to carry out such projects as slum clearance and mass housing. Mr. Buttenheim challenged the program of economy advocates who would cripple necessary social services.

Range of the planning field

Examples of accomplishment in the three fields of city, county and state were contained in papers by William E. O'Brien, city manager of Kenosha, Wis., Hugh R. Pomeroy, Palo Alto, Calif., and Jacob L. Crane, Jr., Chicago, Ill. Mr. O'Brien referred to experience in Kenosha, a city of 50,000 people, where the philosophy of planning has been accepted completely by city administration and the carrying out of a large volume of public improvement work strictly in accordance with the plan has apparently been economical since both bonded indebtedness and tax rates have been reduced during the period of operation.

County planning has been made mandatory by state legislation in California and Mr. Pomeroy described the objectives toward which certain of the more populous counties are pointing, particularly in regard to formulating definite policies with respect to land utilization, zoning regulations for agricultural and the open estate type of development, the development of comprehensive county highway systems and the control of objectionable structures along the highways in rural territory.

State planning undertaken

State planning studies of significant nature have been undertaken in Iowa and Illinois under direction of Mr. Crane. He pointed out the surprisingly great interest and support for the state plan in Iowa, a plan which is unusually complete in scope, covering not only general land policy, the highway system and parks, but a great amount of detail in addition. The studies in Illinois revealed a number of interesting facts, such as the great extent of farm abandonment and the strong probability that this will continue; and the fact that the disribution of industry between large, small and medium size cities, has remained comparatively constant for some forty years and shows little indication of future change.

In view of increasing support for long term financial planning, the conference reaffirmed by resolution what it considers to be a fundamental principle, namely, that the only competent basis for financial planning is comprehensive physical planning.

The following officers were elected: president, Alfred Bettman, Cincinnati, Ohio; vice-president, Col. Carey H. Brown, Rochester, N. Y.; secretary, Flavel Shurtleff, New York, N. Y.

Applications for R.F.C. Loans for Construction Work

Few applications for loans from the Reconstruction Finance Corporation were reported during the past week. The Red Bluff Irrigation District representing four counties in Texas plans to apply to the R.F.C. for a loan of $4,500,000 for the construction of Red Bluff dam on the Pecos River.

Mount Carmel, Ill., proposes to apply for a loan of $100,000 for waterworks improvements and main extensions.

Springer, N. M., plans to ask the R.F.C. for a loan of $37,500 for construction of a municipal waterworks system.

St. Paul Utilities Revalued for Rate-Making Purposes

The city of St. Paul, Minn., has undertaken a revalulation of the electric, gas, and steam-heating plants of the Northern States Power Co. for rate-making purposes. The city has maintained for some time past that the rates charged by the company are too high and that the city is not getting the benefit of the present depressed condition of prices. As its requests for reduced rates have not been acted upon the city has undertaken this revaluation work.

The firm of Burns & McDonnell of Kansas City has been engaged at a contract price of $42,500. The city will supply the services of eight engineers and accountants. The time for the submission of the report has been set at seven months.

Collection of Bidding Fee on Large Dam Abandoned

Action of the county board of supervisors of Los Angeles, Calif., endeavoring to compel the Merritt, Chapman & Scott Construction Co. to forfeit its $168,000 bond for failure to carry out the contract awarded to the concern on its low bid for construction of Dam No. 2, San Gabriel Canyon flood control project, has been abandoned by the board. The abandonment action was voted by the board Nov. 14 in order that Merritt, Chapman & Scott might bid on the contract for the construction of Dam No. 1. Bids on this contract are to be opened Dec. 19. In bidding for the contract on Dam No. 2, Merritt, Chapman & Scott's bid was $1,686,464, which was $452,396 lower than the next lowest bid. Representatives of the company appeared before the board at that time and again on Nov. 14 and declared that in submitting the low figures on the work a clerical error had been made and not one in judgment when the bid was submitted. Upon refusal of the company to accept the contract, the board of supervisors let the contract to the Macco-Lewis Co., next lowest bidder, and brought suit in federal court to collect under the performance bond which had been posted by the Merritt, Chapman & Scott Company. At the hearing on action to abandon the suit, a member of the board of supervisors said he believed the taxpayers would benefit if Merritt, Chapman & Scott were allowed to enter the bidding on Dam No. 1, cost of which is estimated as approximately $10,000,000.

San Francisco Building Trades to Get 20 per cent Wage Cut

A 20 per cent cut in the wage scale of the San Francisco building crafts was announced recently by the Impartial Wage Board to be effective from Jan. 1 to June 30, 1933, or for as long thereafter as economic conditions remain substantially unchanged. Although the scale is 20 per cent lower than the schedule established by the last Impartial Wage Board, the present board believes it is closely in line with wages now actually being paid.

Opinions brought out at the hearing were surprisingly in accord. Under existing conditions it was believed impossible to set a scale providing a proper standard of living; for example in the case of a man working one day a week an adequate wage scale is absurd. It was the hope of the board to set a scale which skilled workmen can demand and, in general, will receive on the better grade of construction work.

The new scale for some of the major construction trades follows:

CRAFT	SCALE
Bricklayers	$9.00
Carpenters	....*
Cement finishers	7.20
Engineers, portable and hoisting	8.00
Iron workers, bridge and structural	9.60
Laborers (6-day week)	5.00
Piledriver engineers	9.00
Plumbers	8.00
Plasterers	8.80
Welders, on structural frames.	9.60
Welders, on other work	8.00
Truck drivers, heavy	7.00

*Wages of carpenters and allied crafts are under study by a special wage board.

No testimony at the hearing suggested that the wage reduction would tend to simulate new construction. Witnesses favored the six-hour day as an aid to unemployment but the board believed that the problems of the individual job made hard and fast rules inadvisable.

Personal Notes

ALPHONSE PARADIS, engineer in charge of the township division, Quebec Road Department, has been promoted to the position of chief engineer of the department to succeed the late ALEXANDER FRASER.

C. B. MCCULLOUGH, bridge engineer, Oregon state highway department, has been appointed assistant chief engineer of the department. He succeeds R. H. BALDOCK who was recently appointed chief engineer of the department.

EDWARD G. BROWN, assistant engineer, U. S. Engineer Office, Louisville, Ky., has been promoted and transferred to Detroit, Mich. Mr. Brown is a graduate of Vanderbilt University and has specialized in hydro-electric work.

I. L. SWEARINGEN, Los Angeles, has been appointed district supervisor of the California State Bureau of Contractors' Registration for the thirteen counties in the southern part of the state. Mr. Swearingen has been actively engaged in contracting in Los Angeles for 10 years. He will be in charge of the southern office including supervision of field inspections and will conduct hearings on complaints.

SOCIETY CALENDAR

AMERICAN INSTITUTE OF STEEL CONSTRUCTION, Detroit, Mich., Jan. 16-18.

AMERICAN ROAD BUILDERS ASSOCIATION, annual convention and road show, Detroit, Mich., Jan. 16-20.

AMERICAN SOCIETY OF CIVIL ENGINEERS annual meeting, New York, N. Y., Jan. 18-21.

AMERICAN SOCIETY OF MUNICIPAL ENGINEERS, annual meeting, Detroit, Mich., Jan. 16-20.

AMERICAN TOLL BRIDGE ASSOCIATION, annual meeting, Camden, N. J., Jan. 16-17.

ASPHALT INSTITUTE, Asphalt Paving Conference, New Orleans, La., Dec. 5-9.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA, annual convention, Detroit, Mich., Jan. 16-18.

HIGHWAY RESEARCH BOARD, National Research Council, Washington, D. C., Dec. 1-2.

HIGHWAY AND BUILDING CONGRESS participated in by twenty national engineering societies and trade associations, Detroit, Mich., Jan. 16-20.

INTERNATIONAL ASSOCIATION OF PUBLIC WORKS OFFICIALS, Detroit, Mich., Jan. 16-18.

ENGINEERING INSTITUTE OF CANADA, annual meeting, Ottawa, Ont., Feb. 7-8.

NATIONAL CRUSHED STONE ASSOCIATION, annual meeting, Detroit, Mich., Jan. 16-18.

NATIONAL PAVING BRICK ASSOCIATION, annual meeting, Detroit, Mich., Jan. 17-18.

NATIONAL READY MIXED CONCRETE ASSOCIATION, annual meeting, Detroit, Mich., Jan. 18.

NATIONAL SAND & GRAVEL ASSOCIATION, annual meeting, Detroit, Mich., Jan. 17-18.

PORTLAND CEMENT ASSOCIATION, Detroit, Mich., Jan. 16-18.

KENTUCKY-TENNESSEE SECTION, American Water Works Association, will hold its annual meeting in Louisville, Ky., Feb. 9-11, 1933.

CANADIAN SECTION, American Water Works Association, will hold its annual meeting in Ottawa, Ont., Canada, March 22-24, 1933.

ENGINEERS' SOCIETY OF MILWAUKEE at its annual meeting held Oct. 19, elected Fraser Jeffrey president and William D. Bliss vice-president.

ST. LOUIS WELDING SOCIETY, at its meeting held Oct. 28, had a demonstration of tests of welded steel connections made in the St. Louis Testing Laboratory as part of its program in support of a proposed revision in the St. Louis building code to permit fusion welding of steel structures.

METROPOLITAN SECTION, American Society of Civil Engineers, devoted its entire meeting of October 16 to a discussion of recent developments in the manufacture of cement. W. J. D. Reed-Lewis discussed the developments in cement composition and in the grinding of cement to obtain high early strength which have taken place over a long period of years, pointing out the progressive developments toward high-lime cements. Mr. Reed-Lewis' paper was discussed by Prof. Lincoln T. Work of Columbia University who paid particular attention to the chemical problems introduced by the fine grinding now resorted to. Professor Work described methods employed in determining the fineness of cement where proper determinations cannot be made with standard sieves. Thaddeus Merriman, chief engineer of the Board of Water Supply of New York, called attention to the fact that the cement specifications for Pine Canyon dam and for Hoover Dam depart from the general trend indicated by Mr. Reed-Lewis. He looks forward to the day when engineers will specify the particular qualities they want in cement other than simply strength requirements. Where fine-grinding is resorted to Mr. Merriman noted the special need for insuring the quality of the cement.

Bids on Four Incinerators Called by City of Detroit

The Detroit Department of Public Works is asking for bids on Jan. 18, 1933, for financing, construction and operation of four garbage and rubbish incinerators having a combined capacity of 1,800 tons based upon 24 hours operation.

Leases will be given by the city on sites at the following locations: 600-ton plant at the Northwestern yards, Buena Vista Ave. and D.T.R.R.; 400-ton plant at D.P.W. site, 24th St. and West Jefferson Ave.; 200-ton plant at the St. Jean yards, St. Jean Ave. between Hern and Shoemaker Ave.; 600-ton plant at the House of Correction site, Alfred St. and Russell St.

The enclosures are to be brick, steel and reinforced concrete in which will be placed incinerators following the design of the individual bidders.

Bids are asked on a tonnage basis for a period of seven years at the end of which time the plants are to be turned over to the city.

Plans were prepared under the direction of Joseph S. Stringham, city engineer, and Laurence G. Lenhardt, commissioner of Public Works.

Funds for Boston Harbor Work

An allotment of $240,000 of the money provided for river and harbor work under the Emergency Relief and Construction Act of 1932 has been approved by the Secretary of War. The work to be undertaken will be dredging to restore the channel between South Boston and the head of the harbor to a depth of 35 ft. at mean low water.

Large Street Widening Project in Los Angeles Abandoned

Abandonment of a $12,000,000 project for the opening and widening of Tenth St., Los Angeles, Calif., has been voted by the Los Angeles city council. It had been proposed to create a 100-ft. wide thoroughfare east and west across the city. Owners of 14,090 of the 21,934 parcels of land affected had protested against carrying the project to completion. The abandonment proceedings, conducted by the council at a session at which more than 6,000 advocates and opponents of the project were present, brings to a close a ten-year fight for and against the plan. It is estimated that the city has expended $191,204 in engineering costs, court costs, appraisers' fees and the like on the project and that additional costs may grow out of demands for recompense for attorneys' fees and court costs from defendants in assessment cases. It is regarded as likely that the owners of large buildings erected in accordance with the proposed new street line will sue for recovery of loss. The question of the city's liability in this connection and in the instance of possible suits by property owners who have been prevented from constructing buildings during the ten year controversy, has never been determined by the courts.

Contracts and Capital

CONSTRUCTION

(Thousands of Dollars)

	Weekly Average Nov., 1931	Nov., 1932	Week Nov. 24, 1932
Federal government	$ 5,556	$ 6,537	$ 3,378
State and municipal	14,952	15,711	9,626
Total public	$20,508	$22,248	$13,004
Total private	14,182	3,363	1,881
Week's total	$34,690	$25,611	$14,885
Cumulative, Jan. 1 to date:			
1931 construction			$2,307,197
1932			1,115,949

Decrease, 50 per cent.

NEW PRODUCTIVE CAPITAL

(Thousands of Dollars)

	Weekly Average Nov. 1931	Nov. 1932	Week Nov. 19, 1932
R.F.C. loans	.....	$3,900	$ 450
New capital issues	$17,000	8,200	12,600
Total	$17,000	$12,100	$13,050
Cumulative, Jan. 1 to date:			
1931 new capital			$1,975,000
1932 R.F.C. loans approved		$136,300	
1932 new capital		740,500	
1932 total			$876,800

Decrease, 56 per cent.

ENR Cost and Volume Index

Cost		Volume	
November, 1932	**158.20**	**October, 1932**	**137**
October, 1932	159.16	Sept., 1932	124
November, 1931	169.28	October 1931	229
1931 (Average)	181.35	1931 (Average)	220
1930 (Average)	202.85	1930 (Average)	260
1913 Average	100.00		

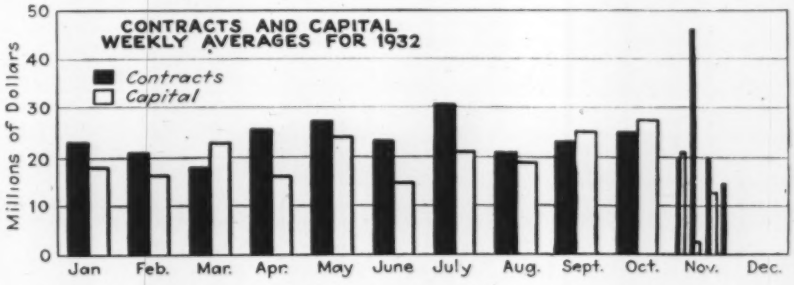
Engineering Contracts and Capital

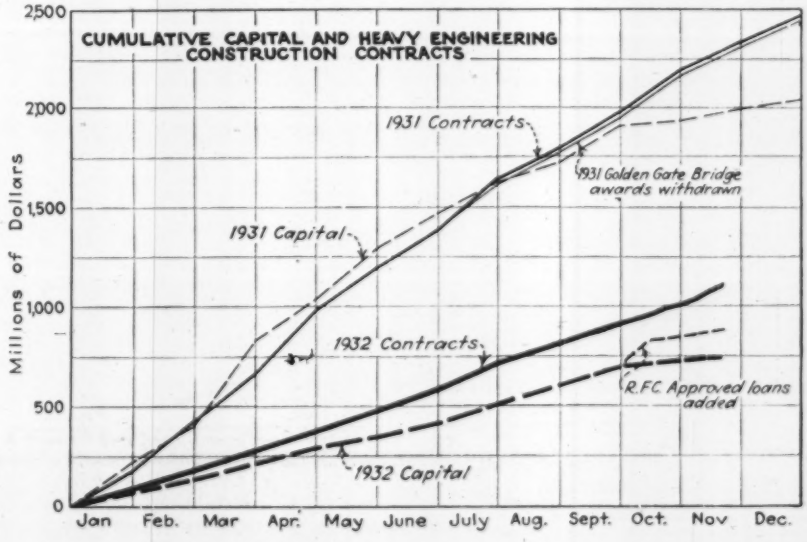
HEAVY CONSTRUCTION contracts reported for the past week total $14,885,000, a low figure due in part to closing of our reports one day early on account of the Thanksgiving holiday. Streets and roads awards amounted to $6,170,000, the lowest figure reported in six weeks. Federal contracts totaled $3,378,000, also the lowest in six weeks. Private contracts were unusually low, amounting to $1,881,000. Large contracts let include highways, Ohio, $859,000; highways, North Carolina, $710,000; highways, Wisconsin, $959,000; incinerators, New York City, $1,431,000; and dredging, Michigan, $980,000.

Proposed projects announced during the week include superstructure of a freight terminal in New York, $2,500,000; an underground high tension line, Fort Wayne, Ind., $1,000,000; housing development, Farmingdale Park, N. J., $3,000,000; cathedral, Montclair, N. J., $1,000,000; race track, Oak Park, Ill., $1,000,000; postoffice, Cleveland (bids received) $2,780,000; and court house, Ft. Worth, $1,215,000.

New capital issues announced for the week total $12,100,000, of which $8,200,000 represented private utility company issues.

No new self-liquidation loans were announced by the Reconstruction Finance Corp. The $450,000 loan listed in the capital tabulation is that for the Tarrant County, Texas, irrigation project, the official announcement arriving too late to be included in last week's tabulations, though mentioned in our news columns.

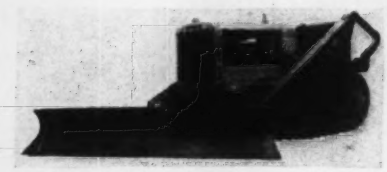




Construction Equipment and Materials

Hydraulic Bulldozer For Caterpillar 35

A new hydraulic bulldozer, known as the Roadbuilder, for use on the Caterpillar 35 tractor is announced by the La Plant-Choate Manufacturing Co., Inc., Cedar Rapids, Iowa. The blade is 9 ft. 4 in. long and is completely oscillating with adjustments provided so that either end can be locked into any position desired. The blade



La Plant-Choate hydraulic roadbuilder

will oscillate up or down at either end 16 in. A sharp all-steel removable cutting bit is provided at each end of the blade. The blade can be set at an angle for backfilling or sidehill cutting work or it can be set straight across for use in bulldozing work.

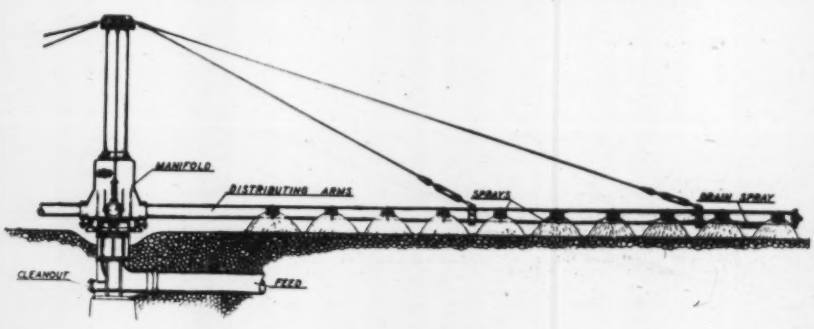
Other features of this 35 Roadbuilder are the 31-in. lift of the blade above ground level; the newly designed main frame and jack which enables the blade to be forced into the ground 20 in. and a design which leaves the tractor drawbar entirely in the clear, enabling the tractor to be used for hauling wagons or any other equipment without removing any part of the Roadbuilder.

Rotating Distributor For Sewage Filters

A new, self-propelled revolving distributor, operating without outside power and requiring hydraulic heads as low as 12 in., is being introduced by the Dorr Co., Inc., under the name of the Dorrco distributor, for applying settled sewage evenly over circular, trickling filter beds. The new distributor consists of four chief parts: a stationary central column and base for supporting the revolving mechanism; a rotating central column and manifold, concentric with and supported from the stationary column; a set of either two or four distributing arms, extending radially outward from the rotating column; and a series of adjustable spray nozzles extending along each distributing arm. The stationary column is mounted on a heavy iron base, and is anchored securely to a concrete foundation at the center of the filter bed. The iron base, in the form of a base ell, is hollow and provided with a connection at one side for the influent pipe and at the top for attaching the vertical column. Vertical ports in this column diffuse the incoming sewage into the enlarged lower portion of the rotating vertical column which completely surrounds the stationary column. The revolving column is supported by a cap which is carried by a single combination radial-thrust, self-aligning roller bearing, mounted on the top of the stationary column.

The spray nozzles are flat in shape and discharge the sewage as a thin, transparent sheet. Due to their staggered positions on the distributing arms, the sprays wet overlapping areas.

Dorrco distributor for trickling filters



Business Notes

INGERSOLL STEEL & DISC CO., Chicago, Ill., a division of the Borg-Warner Corp., announces the consummation of a license agreement with the Allegheny Steel Co., of Brackenridge, Pa., by which the latter will manufacture two-ply stainless steel sheets under the patents of the Ingersoll Co.

ARTHUR WRIGHT & ASSOCIATES is the name of an organization recently formed by Arthur Wright and George W. O'Keeffe to act as process engineers. They will act as general sales representatives of FEinc equipment for Filtration Engineers, Inc., Newark, N. J., and will aim to render expert engineering service on all problems involving filtration in any of the process industries.

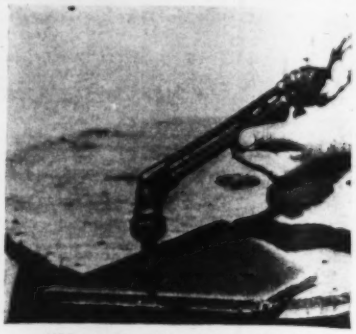
AMERIKA-INTERESSEN, INC., the American unit of A. G. Fuer Amerika-Interessen, has opened offices in New York, N. Y. The company will bring foreign patents to American manufacturers to enable them to exploit new domestic markets. It will also negotiate reciprocal arrangements abroad for American patents. Licenses will be issued on a royalty basis or by the outright sale of the manufacturing and marketing rights for the country involved.

CEMENT GUN CO., INC., announces that a consolidation has been effected with the Cement Gun Contracting Co. The new organization will be known hereafter as the CEMENT GUN COMPANY. The officers of the new company are B. C. Collier, president, and J. K. Mair, treasurer.

NATIONAL EQUIPMENT CORP. has announced the appointment of Carl S. Wagner as general sales manager.

Simplified Cutting Assembly For Welding Torch

To accord with the economic requirements of manufacturing under present conditions, the Smith Welding Equipment Corp., 2619-33 Fourth St., S.E., Minneapolis, Minn., has placed upon the market a new low-price cutting assembly, or attachment, for a welding torch called the "Money Saver" cutting assembly. In its design there has been eliminated many customary features, usually considered necessary in the manufacture of such apparatus, such as levers for the cutting oxygen, adjustable unions to change the position



"Money Saver" cutting attachment

of the assembly in the handle, etc., and substituted for these features valves of simple design. The cutting oxygen valve is a triple-thread, screw valve with knurled thumb wheel, so arranged that it can be quickly opened and closed with the thumb. The valve forging has been reduced to the simplest possible design, the cutting tip automatically evens up the flames. Double seats and all other parts, not absolutely essential to operation, have been eliminated, resulting in simplicity of construction.

New Equipment in Brief

Grader Blade. The Peninsular Grader Blade Co., 1040 McDougall Ave., Detroit, Mich., has announced a blade for road graders which is characterized by its ease of installation and removal. The manufacturer claims that one man can change the blade in only a few moments. The construction of the blade is without bolt holes which permits hardening of the blade, eliminating curling and breaking off. No bolts are used in attaching it to the mold board.

Elevator Bucket. A new design of elevator bucket for heavy duty work is announced by Link Belt Co., Indianapolis, Ind. The new bucket known as Style "AAP" is characterized by a heavy back, a heavy lip, reinforced corners, front reinforcing ribs, reinforcing bead around the ends, and the raising of the middle of the lip to reduce digging strains. The bucket is made of Promal, a new durable metal.

Catch Basin Bucket. The Monarch Catch Basin Co., Dime Bank Building, Detroit, Mich., has introduced a bucket for use in catch basins designed for ease of removal. A pair of plungers operate so as to break the bottom vacuum or mud seal as soon as a lift is exerted on the bail. The standard size has a diameter of 23½ in. and a capacity of 9 cu.ft. Other sizes can be furnished as desired.